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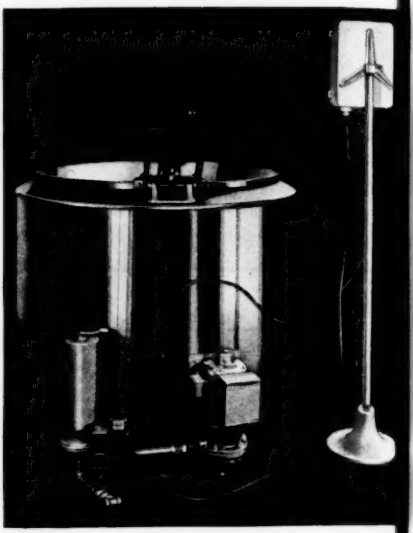

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Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in its transactions.

Pasteurization of Ice Cream Mix

One of the newer developments in the public health regulatory program is the increasing attention devoted to the sanitation of ice cream manufacturing and handling. Fabian (5) showed in a really significant way that infected ice cream was a potent source of communicable disease. Since then, one community after another has enacted regulations in an effort to safeguard the production and consumption of ice cream from the standpoint of these health hazards.

It is generally recognized that pasteurization of ice cream mix is the most important single treatment—as in the case of milk. Experience in milk processing has shown that the temperature to which the milk is heated and the length of time of treatment are fundamental considerations. Laboratory studies on the bactericidal adequacy of the specification of heating milk at 142° F. for 30 minutes have been very numerous. However, this problem of adequate milk treatment is simple in comparison with that of ice cream mix. Within a relatively narrow range of composition, milk is a fairly constant product as it is encountered by the regulatory officers in a given community. This is not the case with ice cream. Ice cream is manufactured from a wide variety of products. The formula of each brand of ice cream may vary from the others, and a plant may change its formula according to convenience and prices.

What is the correct temperature for pasteurizing ice cream? In view of the wide divergence in time and temperature for pasteurizing ice cream, ranging from 140° F. for 30 minutes, to 185° F. for 10 minutes, as shown by Zoller (13), this is a very pertinent question. Fabian (4) has shown that there are at least four considerations in evidence today that are influencing the time and temperature of pasteurizing the ice cream mix.

1. The killing of pathogenic bacteria commonly associated with ice cream and dairy products.

Oldenbush, Frobisher and Shrader (10) found that cultures of *Eberthella typhi,* beta hemolytic streptococci, *Corynebacterium diptheriae,* and bovine tubercle bacilli

were killed in ice cream mix within six minutes at 145°F. and within three minutes at 150° F. On the basis of this work, the Committee on Dairy Products and Eggs (12) of the American Public Health Association concluded that 143.5° F. for 30 minutes recommended by them allowed an ample margin of safety for the pasteurization of commercial ice cream.

2. Pasteurization to meet the requirements of bacteriological standards.

At present there are 12 states and a great many cities that have bacteriological standards for ice cream. While there is some variation in the standards, a majority of them have adopted 100,000 per gram or milliliter (cubic centimeter) as the standard. This figure has been established since a number of investigators (3), (6), (11) have shown this to be a reasonable standard, possible to attain consistently if the mix is pasteurized at 150° F. for 30 minutes. Lower temperatures may be used but greater care is necessary consistently to produce low count ice cream. It is for this reason that we have come to associate pasteurizing at 150° F. for 30 minutes with a bacterial standard of 100,000 per gram.

3. Pasteurization to eliminate the coliform group.

The use of the *Escherichia coli* test as an index of milk pasteurizer efficiency and as a test to detect recontamination of milk after pasteurization is fast gaining acceptance. A few years ago, there was strenuous objection on the part of some to the use of this test because of putting the same emphasis on the test for milk as for water. The *E. coli* test has been used so long for detecting sewage polution of water that it is hard to think of it as being used in milk for any other purpose than to detect manurial pollution. However, those who employ the test in the dairy industry for pasteurizer control are not concerned with its natural habitat or with the fact that these organisms may occasionally be pathogenic either for humans or animals. They are interested rather in the characteristics of the Escherichia Aerobacter group in their relation to milk. Since they are present in most samples of raw milk, they multiply rapidly when present and outgrow many other types of bacteria. However, they are practically all killed by the usual pasteurization procedures and can be detected by simple laboratory tests when present in small numbers. These characteristics make them of value in milk control work in checking pasteurizing efficiency and recontamination.

However, in ice cream we have a somewhat different picture. Beavens (1), Fay (7), and Fabian and Coulter (3) have shown that the sugars, lactose, and sucrose, present in ice cream have a protective action on *E. coli.* The last named authors (3) and Myers & Sorensen (9) also showed that there were resistant strains of *E. coli* that were not killed at 150° F. at 30 minutes but required 155° F. for 30 minutes for killing. In actual practice many factories pasteurize at 160° F. for 30 minutes to be absolutely sure of a colon-free ice cream.

Another consideration in connection with using the coliform test to determine the efficiency of pasteurization is the fact that, as previously stated in this paper, fruits, nuts, flavoring, and extracts may have coliform bacteria present. Since these ingredients are added after pasteurization, this would destroy the value of the coliform test as a test for pasteurizing efficiency in ice cream unless these substances were tested and found free of these bacteria, or treated to destroy them before they were added. Therefore, the coliform test for pasteurizer efficiency and to detect recontamination of ice cream should be used with caution.

4. Pasteurizing for economy.

It has been shown by several workers, Dahl and Barnhart (2) and Hening (8) and others, that high pasteurizing temperatures reduce the viscosity of the mix, increase protein stability, and shorten the freezing time. These last named factors are important from an economical as well as a bacteriological standpoint since they do away with or greatly reduce the need for utilizing an aging period.

In summary then it can be said that the pasteurizing temperature of the ice cream mix has been gradually increasing in most modern factories, not for any sanitary reason but due to physical and manufacturing advantages. It would, therefore, seem that we have little to worry about if all those who manufacture ice cream follow the general trend.

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F. W. F.

(Editor)—In view of the above factual presentations, it seems that a temperature of 160° F. has proved adequate, measured from both the technological and epidemiological standpoints. There is a tendency among regulatory officers to raise the heating requirement to 165° F. No data have been published to substantiate either the need or even the desirability of raising this temperature specification. Such action constitutes an unwarranted burden on the industry—it adds to the cost of production and yields no advantage to the consumer.—(J. H. S.)

Should an Opportunity be Wasted?

The increasing quality-mindedness of the public has directed the attention of food manufacturers and dealers to improvements in the design and operation of their plant equipment. In some cases, the food industry itself has taken the initiative in developing new standards of plant performance. This is particularly noted in the dairy industry. Progress seems to be more active in equipment design than in improvement of the materials of construction.

Food must contact equipment surfaces. What happens to the food—and to the surfaces? We know some effects. There is more that we do not know.

Fundamental investigations on corrosion properties of so-called stainless steels are not now receiving the attention they deserve. The technical literature is meager in papers which deal directly or indirectly with solutions of problems which constantly arise in the application of these steels. Furthermore users are prone to consider the term "stainless steel" as meaning a specific product, whereas the term actually covers a wide variety of steel alloys. Initial rates of corrosion and pitting tendencies in the wide variety of solutions used in the food and dairy industries at present are

unknown. On the other hand, fundamental corrosion studies of iron and steel have provided the basis for predicting the behavior of iron and steel equipment in contact with many liquids and gases, and for initiating steps to prevent corrosion.

Chromium-nickel steels and analogous alloys in most instances, however, behave differently as compared with iron in the same environment. In general, the stainless steels in the food industry give comparatively excellent service. It is known, however, that in certain solutions, the so-called stainless steels corrode more rapidly than do ordinary steels; in others, failure, if met with, is by pitting. Food manufacturers should know what to expect, as well as what precautions to take to minimize corrosion of costly alloy equipment. Such fundamental information is not available, unless perhaps in a superficial sense.

We are convinced that better steels can be produced with better knowledge of the cause of deficiencies in present-day alloys. We also believe that misapplications of stainless steels, still met with in industry today, could be avoided by assembling sufficient fundamental information. Studies of this kind would probably net sufficient value to the food industries alone to merit their financial contribution to a fundamental research program.

Manufacturers of dairy equipment know that they cannot fabricate units better than the materials of construction allow. Purchasers of dairy machinery should know far more about the quality and performance of the metals and alloys in their plants than seems to be the case. In the present state of affairs, the dealer relies on what the equipment manufacturer tells him. The equipment manufacturer gets his information from the mills.

The dairy industry is a buyer's market. Therefore it is in a position to demand adequate information about the metallurgy of its purchases in order to provide a basis for effective specifications.

In such a situation, the most powerful stimulus is the demand of a prospective customer. It is common knowledge in the dairy industry that its interest in the performance of the materials of its purchases did stimulate a great research and improvement program in supply quarters where initially the fabricators were content to rest on the situation - as - is (was). Consumers' demands became manufacturers' objectives. The trade organizations of dealers, manufacturers, and sanitarians can make this need vocal. The metals producers and the mills should take seriously the need for this information, not only to satisfy their customers' demands but also to provide the basis for intelligent and properly directed further development of new materials for specific uses. Research is the life of industry, and when it stagnates, progress is retarded.

In 1935 at the Massachusetts Institute of Technology, the Chemical Foundation began a fundamental program on the study of stainless steels. With the expiration of certain patents held by the Foundation, support was discontinued a few years later. Within that period new ideas were contributed and papers published on the fundamental corrosion mechanism in stainless steels which go part way in answering questions which arise in applying these alloys. There is grave danger that the program which has produced such promising achievements may have to be abandoned due to lack of financial support. On economic grounds, there is every reason for continuing accumulation of basic information on stainless alloys—information which will ultimately decrease production costs and increase quality of food products.

Only a small percentage of the money now expended in costly plant experimentation would be ample to finance a basic research program. Such information should preferably come from a laboratory inherently free from the pressure of the Sales Department and unbiased in all its verdicts in the strictly scientific sense. The industry would profit by many times the initial investment and another opportunity capitalized to advance our industrial frontiers.

J. H. S.

Report of the Committee on Sanitary Procedure

International Association of Milk Sanitarians for 1939

W. B. Tiedeman, *Chairman*

State Department of Health, Albany, N. Y.

Your committee on sanitary procedure has continued work along the lines outlined a year ago. In cooperation with the Technical Committee of the Dairy Industries Supply Association and the Committee on Milk Plant Practice of the International Association of Milk Dealers, more items have been accepted, studies have been made of items proposed for standardization, and considerable progress has been made. In addition to this, at the suggestion of one of our members, Dr. Grim, a study has been started of plastics used or proposed to be used for parts or surfaces in contact with milk in milk plant equipment.

COMMITTEE PROCEDURE

It is quite evident that the value of the work of this committee will depend largely upon getting the broadest criticism from health officials throughout the country upon items proposed for acceptance, and then securing the general cooperation of health officials in permitting the use of items accepted or standardized. Furthermore, it appears to be desirable

PROPOSAL

To the Committee of Sanitary Procedure

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

of Item for Aceptance and for Standardization

Under the Three Association Program

Submitted by ..... Date.....

Title

Address

Description of Item .....

Prints attached numbered .....

Action proposed .....

Public Health reasons for proposal:

1.
2.
3.
4.
5.

Signed.....

NOTE: Leave space below for committee use.

Submitted to committee members
Outside comment invited
Discussed at meeting
Submitted to I.A.M.D. Committee — Action
Submitted to D.I.S.A. Committee — Action

Final Action Taken:

Form to accompany submission of reports for acceptance of designs of equipment.

to give wider publicity than heretofore to items accepted by the committee. An orderly procedure for carrying on the work of the committee also has been developed.

As a first step, we have prepared a letter to health officers of states, provinces, and the larger municipalities in the United States and Canada, advising them of the work and procedures of the committee and inviting them to cooperate with us. A form has been devised, a copy of which is attached, upon which any person may submit to the committee any item proposed for acceptance or standardization by the committee, with supporting evidence as to necessity. The members of the committee have agreed to meet quarterly to facilitate action.

ACCEPTED ITEMS

Among the items accepted and standardized by the committee since the last report are the following:

(1) a removable nut for attaching indicating thermometers to equipment as an alternate for the nut that slips over the thermometer case, *

(2) a bend designated as 2F with ground seat and 2FG with gasket for male and female connections (see Figures 1 and 2),

(3) an increasing or reducing fitting, designated as 32-15 and 32-15G (see Figure 3),

(4) a device with metal umbrella for inserting indicating and recording thermometers through the covers of pasteurizers without the use of threads (see Figures 4 and 5),

(5) a substitute for the 4 in 1 fitting for interchangeably installing thermometers in pipe lines for existing equipment except flow diversion valves** (see Figure 6). In addition to this:

* Shown on pg 94, JOURNAL OF MILK TECHNOLOGY, Vol. 2, No. 2, March 1939.

** A new development of this fitting intended for general use is being submitted for further study.

PLASTICS

The work on plastics has been under way for only a few months and at this time we can only indicate the progress made. Of the twenty-two replies to our inquiry to manufacturers concerning the use of contemplated use of plastics for surfaces in contact with milk, fourteen reported no use and eight reported the use of plastics in some form for the most part in an experimental way.

Hard plastics resembling hard rubber or bakelite in appearance are being used in making paddles for pasteurizers, sidewall scrapers for counter-current vats, rotors or impellors for pumps, valve plugs, sanitary fitting caps, teat cups, and miscellaneous moulded parts. These include bakelite, rulene 100, synthane, baltic 70-a, formica, lucite, ohmid, and other products as yet unnamed but described as being made from phenolic resins.

Flexible plastics somewhat resembling ordinary rubber are being tried for pump diaphragms, vacuum pans, gaskets, and rotary seals. These include rulene 400, buna, duprene, neoprene B, and rub-erok R-523. Apparently rubber forms the base for plastics of this type.

Coatings for steel tanks or other parts of equipment form a third group of plastics. We have not included in this study the baked-on glass enamels used on the well known glass-lined steel equipment as these have been quite generally used for some time past. A product known as lithcote, described as a synthetic resin of the phenol formaldehyde type, and an industrial coating named heresite are being used for lining or relining milk storage tanks. Another product known as A & W four-A is proposed for use in lining steel drums for shipping condensed milk. All of these products are baked on at the factory.

An important consideration is the toxicity of these products, their durability, solubility, and possible effect of these plastics on the flavor of milk or milk products and of the milk or milk products on the plastics at various temperatures. Dr. H. J. Brueckner and Dr. E. S. Guthrie

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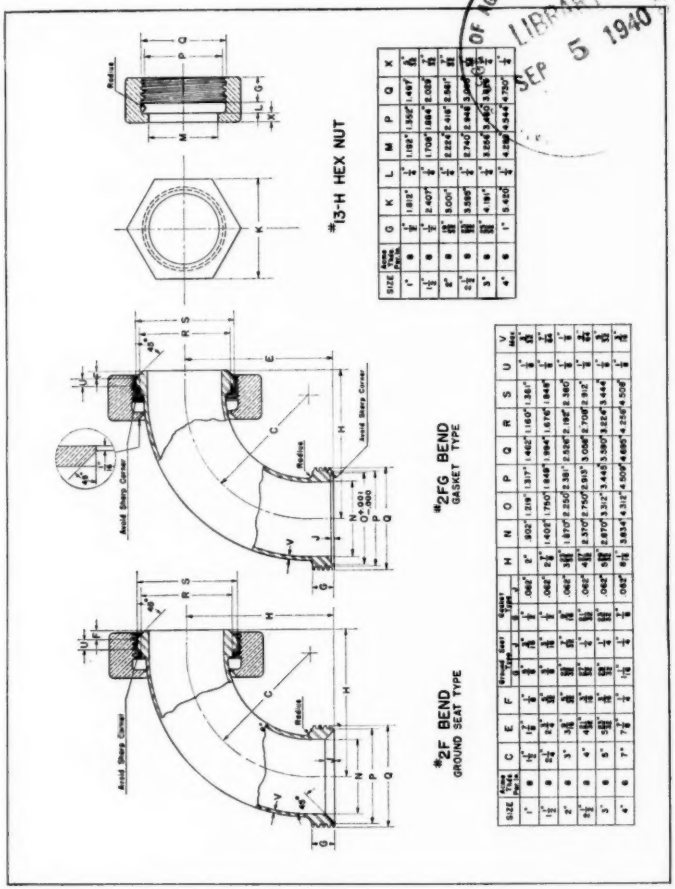
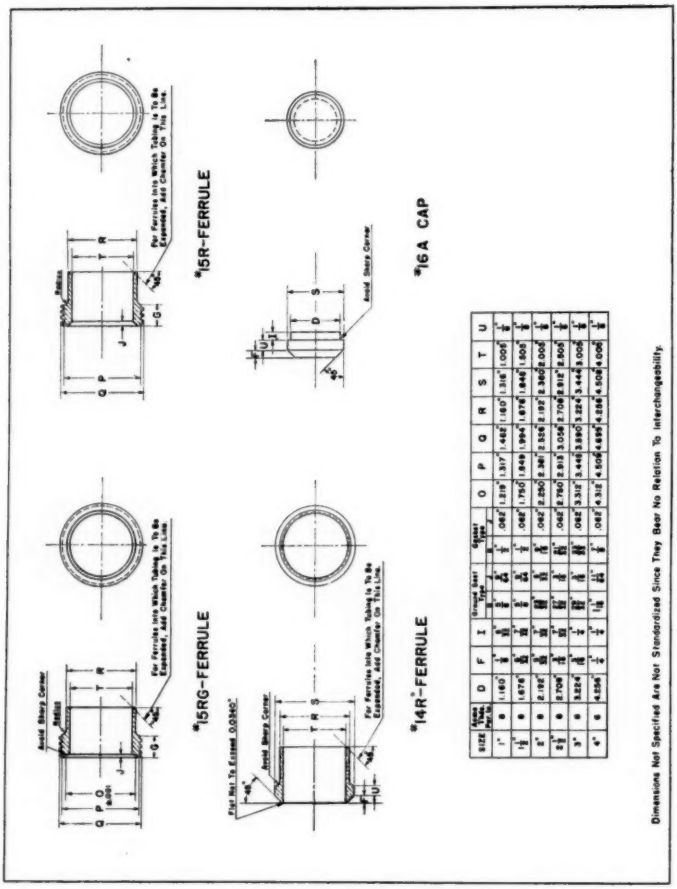


FIGURE 1—*Standard bends and nut*

of Cornell University are making a study of this for the committee but the work has not progressed far enough to include in this report. At least one manufacturer indicated that he used a certain plastic only in contact with cold milk or at least not for alternating hot and cold milk, the implication being that changes in temperature had an adverse effect on the plastic.

Most users reported a very limited experience with plastics. Their comments in favor of certain of these plastics included reasonable cost, light weight, machine-ability, non-galling action when in contact with steel, low moisture absorption, and ease of cleaning. Objections to certain plastics include difficulty in controlling composition, shoddy appearance after repeated handling, lack of strength for certain uses, objectionable color, ob-


*15R-FERRULE
*15RG-FERRULE
*16A CAP
*14R-FERRULE
Avoid Sharp Corner
Radius
For Ferrules Into Which Tubing Is To Be Expanded, Add Chamfer On This Line
Flat Not To Exceed 0.0345"
Dimensions Not Specified Are Not Standardized Since They Bear No Relation To Interchangeability.

SIZE	Nom. Bore Per In.	D	F	I	Ground Bore	Upper Bore	O	P	Q	R	S	T	U
1"	8	1.90"	1"	1"	1"	1"	.062"	1.219"	.317"	1.442"	1.187"	.318"	1.000"	1"
1½"	8	1.676"	1"	1"	1"	1"	.062"	1.750"	1.949"	1.994"	1.676"	1.843"	1.500"	1"
2"	8	2.192"	1"	1"	1"	1"	.062"	2.250"	2.387"	2.556"	2.192"	2.362"	2.000"	1"
2½"	8	2.704"	1"	1"	1"	1"	.062"	2.750"	2.913"	3.068"	2.704"	2.812"	2.500"	1"
3"	8	3.324"	1"	1"	1"	1"	.062"	3.312"	3.449"	3.690"	3.324"	3.443"	3.000"	1"
4"	8	4.356"	1"	1"	1"	1"	.062"	4.312"	4.506"	4.699"	4.356"	4.506"	4.000"	1"

FIGURE 2—*Ferrules and cap*

jectionable odor, adverse effects of marked changes of temperature, open grain, and lack of elasticity in certain hard plastics. It should be kept in mind that this is a summary of comments for and against certain plastics for certain uses and should not be considered as of general application.

It appears from our studies to date that there may be a place for certain types of plastics under some conditions for surfaces and parts in contact with milk or milk products. Considerably further work is necessary before any more definite conclusions can be drawn.

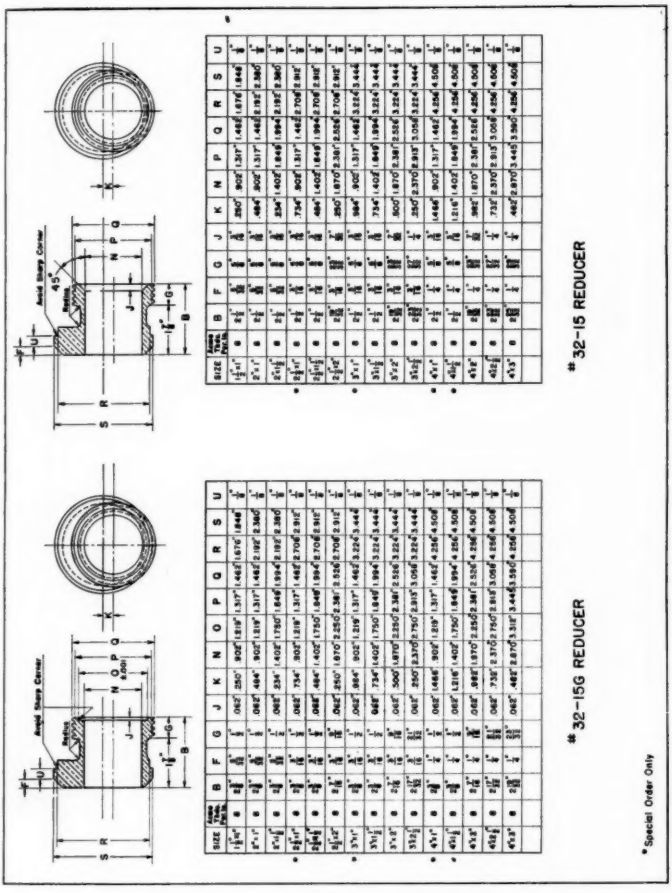
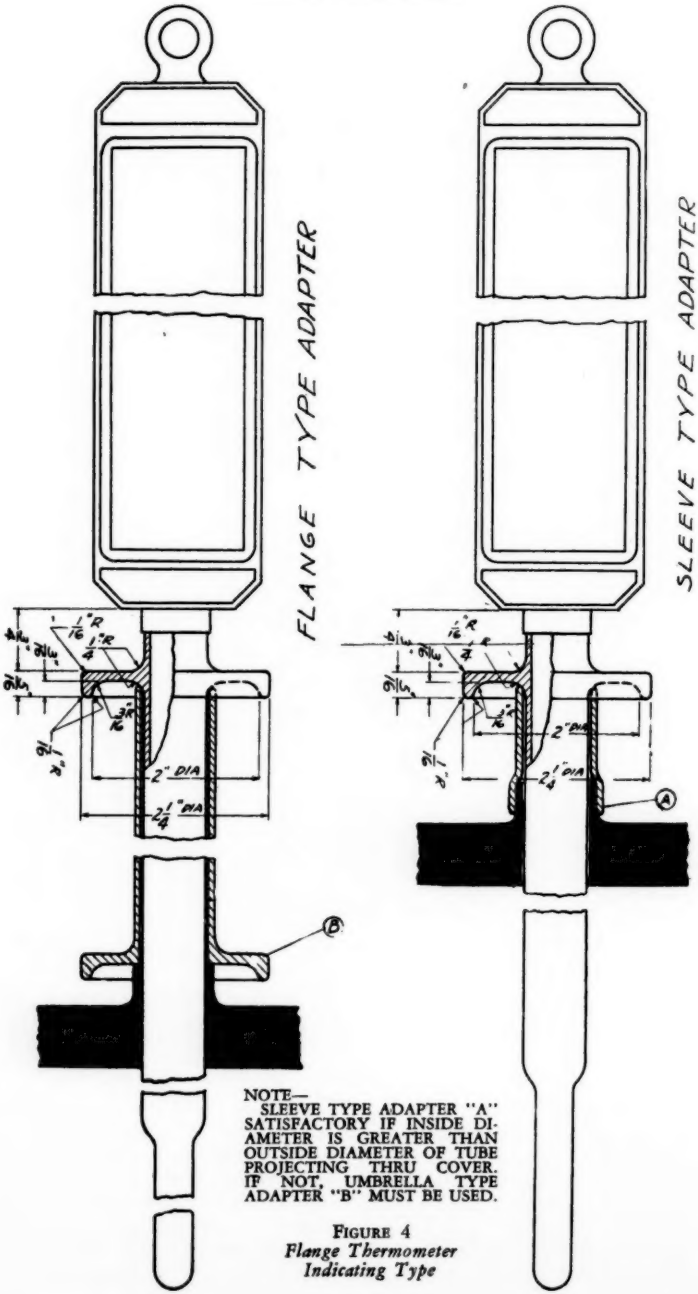


FIGURE 3—*Standard reducers*

FUTURE WORK

As for the general work of the committee, additional reports will be published from time to time in your journal i. e. the *Journal of Milk Technology*, in *A-Q*, and possibly in the *Milk Dealer*. The cooperation of every member of this association is solicited: (1) in submitting, on the new form, items that require improvement or standardization; (2) in offering constructive criticisms of new items presented for committee consideration; and finally and most important, (3) in urging all regulatory officials to accept items that have been accepted or standardized by the committee.



NOTE—
SLEEVE TYPE ADAPTER "A" SATISFACTORY IF INSIDE DIAMETER IS GREATER THAN OUTSIDE DIAMETER OF TUBE PROJECTING THRU COVER. IF NOT, UMBRELLA TYPE ADAPTER "B" MUST BE USED.

FIGURE 4
Flange Thermometer Indicating Type

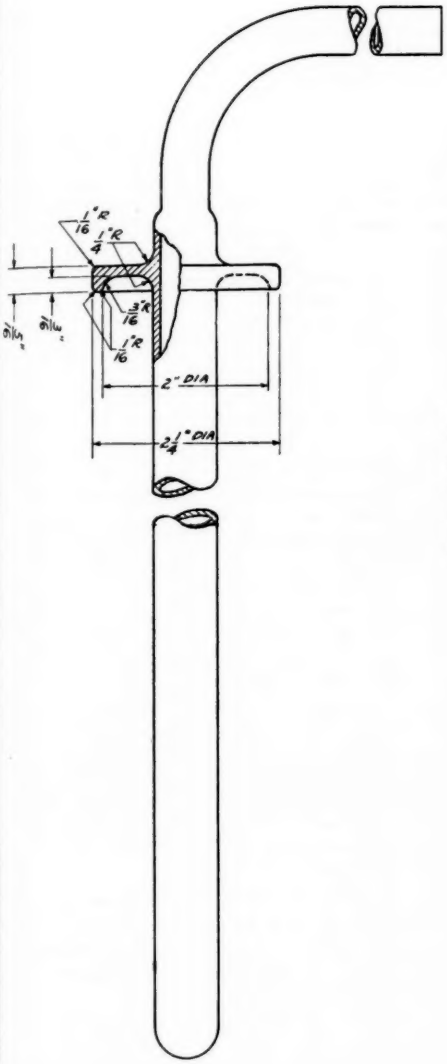


FIGURE 5
Thermometer flange (for vat cover use)—Recording type

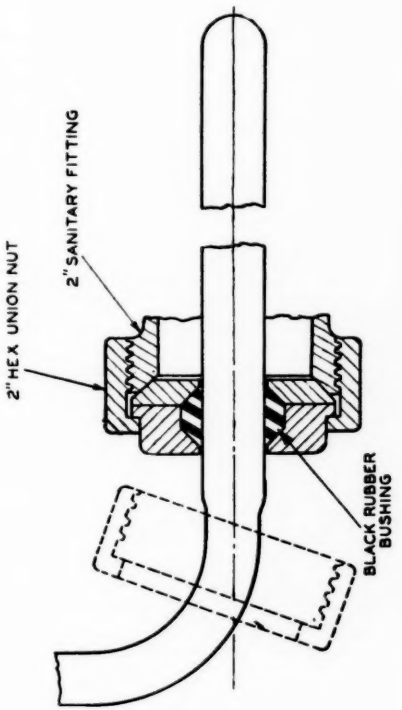


FIGURE 6
3A Thermometer Adapter No. 1 (for pipe lines)

Report of Committee on Ice Cream Sanitation *

F. W. Fabian, *Chairman*

One of the functions of a Committee such as this in a technical Association like ours is to keep in touch with the latest developments in the industry, and report them to the membership so that they may be informed of these developments at all times. In addition to this, certain conditions or abuses creep into the industry either by design or accident. Unless corrected, these lead to unsatisfactory sanitary conditions.

RECENT ADVANCES

Possibly the outstanding advance which has been made in recent years from a sanitary standpoint is the discovery that products added to the ice cream mix after pasteurization are potential sources of contamination heretofore unsuspected or ignored. Bacterial analysis of these products have shown (1, 2, 3, 4, and 5) that they may be not only prolific sources of bacteria but also potential sources of disease.

Recent work has shown (6) that it is not only possible to eliminate or greatly reduce the bacterial content of the ingredients entering the ice cream mix after pasteurization but in many instances actually to improve the quality of the product.

From all the information at hand, it would seem to be reasonable to require manufacturers to give all ingredients added to the ice cream mix after pasteurization a treatment equivalent to pasteurization.

SUGGESTED STANDARDS FOR INGREDIENTS

Since this is a recent development in ice cream sanitation, some sort of standards should be suggested to guide those who are not familiar with this particular phase of the subject. Hook and Fabian (7) suggested a bacterial standard of 5000 per ml. for flavoring and fruit syrups. Prucha (8) in a personal communication suggested the following maximum bacterial plate counts for these materials:

Total bacterial plate counts	*per ml. or gram*
Coloring solutions	10,000
Flavoring extracts	100
Fruits	1,000
Nuts	100
Absence of coliform organisms	
Absence of hemolytic streptococci	
Yeast and mold count	10

EDUCATION AND SERVICE

California apparently has done more on ice cream control than any other state. It was first to enact a law setting up a bacterial standard of 150,000 bacteria per gram in 1927. In 1928 it started a program of education and service. In 1937, after ten years of helping and teaching the manufacturer, the legal standard was lowered from 150,000 to 75,000 bacteria per gram. Milner (9) shows that in 1928 only 55 percent of the samples analyzed came within the 150,000 range, whereas in 1938, 95.5 percent of the samples came within this standard and 93.5 within the 75,000 standard. Truly this is a remarkable tribute to education and service on the part of the inspection personnel.

REPORTS OF OTHER COMMITTEE MEMBERS

Dr. Andrew J. Krog, Health Officer of Plainfield, N. J., and one of the members of this Committee has contributed the following to this report.

1. Continuous Freezer Operations

(a) The installation of continuous freezing units in many plants has caused drastic changes in mix-manufacturing practices. Plants using continuous freezers have revised their operative procedure to prepare mixes in large quantities in order to use the versatility of this equipment. It is important that the mix storage tanks be equipped with adequate refrigeration and insulation in order that the mix can be maintained in proper condition. Temper-

* Presented at 28th Annual Meeting of the International Association of Milk Sanitarians, Jacksonville, Fla., October 25-27, 1939.

atures above 35° F. are unsatisfactory for mix storage held over twenty-four hours.

(b) Sterilized color solutions are readily adapted to continuous freezer practices. The batch of ice cream mix to be frozen is generally drawn into a small accessory mix tank from the mix storage tank. Some plants have learned that the packing of color solutions in individual unit bottles holding just enough for one batch and sterilized in the unit bottle before using has been an important factor in the reduction of the coliform index. It has been found that the colors have been an important medium in the disseminating of these and other organisms.

(c) The cleaning and sterilizing of fruit injectors and other equipment used in conjunction with continuous freezers is still an important problem and must be thorough if we are going to have a satisfactory product with a minimal bacteria content. The rapid development of automatic equipment for packaging will soon, by virtue of its efficiency, eliminate the practice of hand packaging.

2. The Use of Plastic Cream and Butter in Ice Cream.

(a) Plastic cream is coming more and more into use as an ingredient of frozen dessert mixes. Since this product is made in the same manner as cream, I feel that the bacterial standards invoked for cream should be applied to plastic cream.

(b) Butter is frequently used as a mix ingredient. Some localities demand that the cream used by the manufacturers of butter for ice cream mix have the same standards bacteriologically as the cream used for the ice cream mix. I might suggest that some thought be given to the necessity of adopting plastic cream and butter standards.

(c) Butter oil is not generally used in ice cream manufacture. This product is usually sterile but has occasionally been found to contain certain lipolytic organisms. The bacterial specifications of this product should be defined.

3. Preparation of Fruits and Nuts.

(a) Research over the past year relative to the preparation of fruits for ice cream generally has demonstrated that bacteriologically sound products can be obtained if intelligent care is observed in the preparation, handling, and storage operations. Control officers will materially aid the ice cream industry by having the manufacturers of these products in their territories incorporate bacterial specifications in their fruit orders, and by observing that bulk fruits are handled in such manner as to prevent contamination.

(b) Nuts, like fruits, should be added to the ice cream mix at the freezer. Insistence on satisfactory sanitary specifications of the product furnished by nut packers will materially assist in avoiding contamination of the ice cream at the final stage of manufacture. We must also bear in mind that the roasting of nuts may destroy micro-organisms. It does not, on the other hand, remove dirt and filth. (I personally prefer to have my worms and other vermin alive and wiggly—they are more easily detected than when they are roasted and shriveled up.)

4. French and Custard Ice Cream.

(a) Practically all ice cream laws state that French and custard ice creams must contain egg products (to a specific degree) and must be free of color in vanilla. Although the determination of egg content by laboratory analysis is an involved procedure, the determination of the presence of artificial color is not. More attention to this test will materially decrease the misbranding practice in many areas.

I wonder to what extent, if any, incubator reject eggs are used in conjunction with the manufacture of this product.

5. Sanitation in Retail Outlets.

(a) Enforcement of sanitary requirements at ice cream plants is of little value if the product is subject to contamination at the retail outlets. Some manufacturers and others who operate retail stores rigidly train their personnel in the principles of proper fountain sanitation and hygienic methods of handling their products, and equip their establishments with proper facilities for sterilizing their equipment and handling their products in a sanitary manner. The sanitary condition of frozen dessert products will be materially improved if control officers will see to it that similar features are installed and proper dispensing routines are carried out in all of the retail outlets under their jurisdiction.

(b) In connection with retail establishments, the examination of whipped cream, milk, syrup, and flavor-dispensing apparatus will be in the majority of instances extremely illuminating. There is no question in my mind but what these are important factors to be considered in conjunction with the sanitary control of the retail dispensing of frozen dessert products.

6. Laboratory.

(a) The coliform index is the most reliable type of indicator of contamination following pasteurization that we have yet been able to apply, if the heat treatment is of high enough temperature to insure 100% kill of this group of organism at the time of mix pasteurization. The coliform determination can be conveniently incorporated in the routine of any plant or official control organization, especially with the new direct plating media. It should be universally adopted.

(b) I doubt the necessity of saying much about the phosphatase test in conjunction with frozen milk products because I feel that there will be much said by many who are authorities on this subject. I do feel, however, that this test, when run with appropriate controls, frequently aids in understanding the conditions under which specific ice creams have been manufactured. (Editor—Specifications for making this test are now being worked out by American Public Health Association.)

ICE CREAM PROBLEMS IN CANADA

Another of our Committee members, W. C. Cameron, of the Federal Department of Agriculture, Ottawa, Canada, has raised some very pertinent questions regarding the physical aspects of the ice cream problem. These are real problems to any control agency which is trying to protect the public without working undue hardships on the manufacturer.

1. Overrun

(a) There seems to be a very wide difference of opinion between authorities as to the most adequate method of controlling overrun—existing state and Canadian laws are evidence of these differences. Should there be a uniform law regulating ice cream overrun common to all states and Canada, and if so, what is it?

(b) Can the actual overrun in counter freezers and small plants be satisfactorily controlled from the time the product is ready to draw until the last is removed from the freezer?

(c) If there is a variation in the air content of packages of ice cream from the same batch, should a tolerance in weight be allowed, and if so how much?

(d) How can weight of bulk ice cream be checked when it is encountered on retailers' premises where no scales are available? Could a "trier" be made to draw a definite volume of ice cream; then the trier and the ice cream weighed on a small portable steelyard? (Editor —This problem will be immediately taken up by the American Public Health Association.)

2. Standardization of Packages

Is it in the interest of the industry to specify by law the legal size or capacity for ice cream packages with a net volume of contents of 5 fluid ounces or over?

3. Milk Solids.

(a) Most ice cream and sherbet definitions include a standard for a definite percentage of milk solids or milk solids-not-fat. How can the milk solids-not-fat in ice cream or sherbet be determined accurately and quickly? (Editor —Such a method is under study by the American Public Health Association.)

(b) If milk solids-not-fat cannot be determined accurately by analysis, what control can be exercised on "so-called" sherbets which are actually substandard ice cream and which seem to be gaining favour as a cheap ingredient for milk shakes and sodas?

4. Ice Cream Cabinets.

How far should a state or county go in legislation as to the manner in which cabinets should be used, i.e.

(a) Prohibiting one manufacturer from storing ice cream in a cabinet the property of another manufacturer?

(b) Preventing the storage of products other than ice cream in cabinets?

5. Road Side Ice Cream Stands and Counter Freezers.

(a) What is the correct method of inspection to safeguard the products handled by these retailers?

(b) Shipping mix long distances creates problems of both health hazards and quality defects.

6. Dispensing of Ice Cream in Retail Stores.

(a) There is still a lot of educational work to be done here—unsightly and dangerous method of handling dippers, etc.

(b) Does the square fibre-board containers for bulk ice cream increase the dipping loss (at counters)?

7. Some fast-frozen ice cream made in the continuous freezer type of machine shows a curdy appearance upon melting. What is the cause of this defect and how can it be remedied?

8. What is the most satisfactory test for both field and laboratory use for determining whether or not an ice cream mix has been pasteurized? (Editor—This problem is under investigation by the American Public Health Association.)

COUNTER FREEZERS

The counter freezer situation is clearing up in most localities by requiring them to conform to all the rules and regulations required in producing ice cream, irrespective of the size of the plant. This is the only safe way to handle the situation. Any health department doing less than this is assuming unnecessary responsibilities which it has no right to assume in the interest of the public health.

UNIFORMITY OF REGULATIONS

This Association as well as state associations should take cognizance of the multiplicity of inspections existing in many communities. This is a vicious cycle, and should be corrected. The principles of milk sanitation are simple and easy of application. Inspectors should first decide what they consider essential, and then pass these essentials on to the manufacturer. If there is confusion amongst the inspectors, how can they enlighten the producer?

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Improvement of the Hotis Test for the Detection of Mastitis Streptococci *

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INTRODUCTION

The Hotis test (4) was devised as a simple test for the detection of mastitis streptococci. In brief it consists of adding 9.5 ml. of milk to 0.5 ml. of a 0.5 percent aqueous solution of bromo-cresol-purple in a test tube, incubating for 24 to 48 hours and examining for the development of canary yellow flakes in the milk with or without the production of acid, or the development of acid without the appearance of flakes. Work by various investigators has shown that many borderline or "suspicious" reactions occur with this test. The difficulty in interpreting these "suspicious" reactions has led some workers to condemn the test as being unreliable.

A procedure now in common use for the detection of mastitis streptococci is Bryan's (1) method of microscopic examination of an incubated sample of milk. However, this test has not been entirely reliable. Fay (3) reported that the test detected 96 percent of the positive and 91 percent of the true negative samples. Shaw, Hansen, and Nutting (8) found that the test detected 92.5 percent of the severe cases and 36.6 percent of the chronic cases, while giving positive tests with 7.1 percent of the uninfected samples.

Since both the Hotis test and Bryan's method have considerable merit, but neither test alone has been entirely reliable, it occurred to us that a combination of the two tests might be a satisfactory solution to the problem. The purpose of this paper is to discuss such a combined procedure and the results obtained with it.

EXPERIMENTAL

In the study of this combined test all samples were further checked by plating 0.1 ml. of the fresh milk on Edwards' (2) aesculin blood agar (higher dilutions were employed when necessary), by microscopic counts of leucocytes, and by direct titration of chlorides. When growth occurred on the plates, representative colonies were picked for further study.

During the course of the experiment two distinct groups of mastitis streptococci were encountered. The group most frequently found had the following typical characteristics of *Streptococcus agalactiae*: A more or less broad zone of hemolysis, but no evidence of aesculin-splitting, occurred on Edwards' aesculin agar containing 5 percent of defibrinated horse blood; 1:5000 methylene blue in milk was not reduced; acid and coagulation, followed by reduction, were produced in litmus milk; sodium hippurate was split; and acid was produced from trehalose but not from sorbitol.[1]

This group will be referred to as the aesculin-negative (A-) group.

The other group of streptococci had the following characteristics: Aesculin was split but no hemolysis occurred on the plates; 1:5000 methylene blue in milk was reduced; acid without coagulation, and with little or no reduction, was produced in litmus milk; sodium hippurate was split; and acid was produced from both trehalose and sorbitol.

This group will be referred to as the aesculin-positive (A+) group. The cases in which this group appeared rarely were acute and usually could be classed as mas-

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1 Observations on methylene blue milk, litmus milk, trehalose broth, and sorbitol broth were made after 1, 2, 4, and 7 days' incubation at 37° C.

titis when the infection became established only by the slight elevation of the chloride and leucocyte content of the milk. It probably is identical with the Group 3 of Plastridge, Anderson, Brigham, and Spaulding (7), which they describe as possessing "a lower degree of pathogenicity than the other strains studied".

Before using the Hotis test as the incubated milk for preparing smears it was necessary to determine whether or not the 0.025 percent of bromo-cresol-purple used in the Hotis test inhibited or retarded the growth of these streptococci. To do this we selected three samples of naturally infected milk and prepared three lots of sterilized milk which were then inoculated with broth cultures of different strains of the streptococci. A smear for a Breed count was prepared from each of these six lots of milk and immediately test tube samples were set up from each lot as in the Hotis test and also without the addition of the dye. After a few hours' incubation at 37° C., a Breed count was again made on each sample of milk. The results are shown in Table 1.

It will be seen from this table that the bromo-cresol-purple apparently did not affect the development of the streptococci. This confirms the work of Jones and Schofield (5), in which they found no inhibition by the dye of even small numbers of the streptococci.

Since the milk in the Hotis test apparently is as good a medium for the growth of mastitis streptococci as is the milk without the dye, we decided to use the 24-hour Hotis test as the incubated milk for the preparation of smears for microscopic examination.

The Hotis tests were always read after 20 to 24 hours' incubation at 37° C. The reactions were classed according to a system based on the one described recently by Murphy (6). It is as follows:

Negative: (Murphy's Class A). Uniform blue column.
Class P: Peptonization of the milk.
Class M: (Include Murphy's Classes 8, 9, and 10). Slight sediment, white, pale yellow, or brownish in color.
Class 1: Small white or pale yellow colonies with chocolate-colored centers, or small chocolate-colored colonies with white or pale yellow centers.
Class 2: Thick yellow deposit in bottom of tube.
Class 4: Small white colonies in blue column.
Class 5: Uniform yellow column.
Class 6: Uniform yellow or green column with gas formation.
Class 7: Yellow colonies in blue or yellow column.

Class M is a miscellaneous group into which we have put all reactions not covered by the other classes.

Our results are based on a total of 1434 individual quarter samples from 37 cows. Of these samples, 225 have been classed as infected with streptococci and 1209 as

TABLE 1.

The effect of 0.025 percent bromo-cresol-purple in milk on the growth of St. agalactiae

Sample No.	Description of sample	Initial streptococci count	Hours incubated	Streptococci count per ml. (Breed) Without bromo cresol-purple	With 0.025 percent bromo-cresol-purple
1	Inoculated sterile milk	650,000	6	Too numerous to count	Too numerous to count
2	Inoculated sterile milk	150,000	6	90,000,000	88,000,000
3	Inoculated sterile milk	360,000	6	Too numerous to count	Too numerous to count
4	Naturally infected milk	1,300,000	5	131,000,000	175,000,000
5	Naturally infected milk	<6,000	5	234,000	359,000
6	Naturally infected milk	<6,000	5	6,500,000	7,500,000

not infected with streptococci. In classifying any sample as infected we have taken into consideration the results obtained by all the tests, including the tests for chlorides and leucocytes. not only of the sample in question but of previous and subsequent samples from the same quarter. Isolated occurrences of streptococci in a quarter, with no streptococci appearing in previous or subsequent samples, were never accompanied by other evidence of mastitis. Furthermore, the streptococci found in those instances did not exhibit the biochemical characteristics of *Streptococcus agalactiae*. When mastitis streptococci were once established in a quarter they usually persisted throughout the remainder of the lactation period or longer.

The results obtained by plating, by the Hotis test, and by examination of the smear from the Hotis test are shown in Table 2. One hundred and sixty samples were found to contain aesculin-negative streptococci. All of these samples fell into classes 2, 5, and 7 in the Hotis test. Three of these samples were not classed as positive by the examination of the smear probably because of a complete breakdown of the chain formation of the streptococci in the preparation of the smear. In addition to the 160 samples, 4 other samples yielding no streptococci on the plates but showing streptococci in the smear, were from quarters subsequently found to be infected with aesculin-negative streptococci. The Hotis reactions on these 4 samples were M (2 samples), 2, and 5.

Of 61 samples containing aesculin-positive streptococci,, only 1 was classed as negative by examination of the smear. The cause of failure to find streptococci in the smear in this case was probably due to overgrowth of the streptococci by large peptonizing rods. Six of the samples in the aesculin-positive group showed no reactions with the Hotis test, 5 fell into Class M, 3 into Class 1, 43 into Class 2, and 3 into Class 7.

Ten samples showing streptococci in the smear were judged, from the results of other tests and from the previous and subsequent history of the cow, to be from uninfected quarters. The Hotis test classed 5 of these samples as negative, while 3 samples fell into Class M, 1 into Class 1, and 1 into Class 5.

The remaining 1199 samples in our experiment gave negative results on the plates and in the smears. The Hotis test classed 964 of these as negative, 106 as Class P, 47 as Class M, 56 as Class 1, 1 as Class 2, 6 as Class 4, and 19 as Class 6. None of the negative samples fell into Class 7, the typical Hotis reaction.

DISCUSSION

These results show that if, when making a survey for mastitis, we rely upon the Hotis test alone, we would encounter certain reactions that would lead to considerable doubt in the interpretation of the results. The Hotis test, however, possesses certain advantages over Bryan's method. First, it permits the estimation of the pH of the sample at the time the test is set up by observing the color of the milk-dye mixture. This furnishes an immediate clue as to the condition of the quarter from which the milk was drawn.

TABLE 2

Correlation of results obtained on the plates, the Hotis test, and the smear from the Hotis test

Findings on plate	Findings in smear	Classification of sample	Number of samples	Hotis test classifications —	P	M	1	2	4	5	6	7
A− St.	+	+	157	0	0	0	0	32	0	36	0	89
A− St.	−	+	3	0	0	0	0	0	0	1	0	2
A+ St.	+	+	60	6	0	5	3	43	0	0	0	3
A+ St.	−	+	1	0	1	0	0	0	0	0	0	0
−	+	+	4	0	0	2	0	1	0	1	0	0
−	+	−	10	5	0	3	1	0	0	1	0	0
−	−	−	1199	964	106	47	56	1	6	0	19	0
Total negative samples			1209	969	106	50	57	1	6	1	19	0
Total positive samples			225	6	1	7	3	76	0	38	0	94

Quarters giving milk with a high pH should always be regarded with suspicion. It indicates either a mechanical injury or an infection, except when a cow is in the late stages of lactation. For instance, in our herd we have frequently encountered *Pseudomonas aeruginosa* infections that persist over long periods of time, alternately becoming acute and returning to apparent physical normalcy. Such cases, as well as mild infections with staphylococci, will usually show an abnormally high pH but will not appear abnormal in the smear.

Another advantage of the Hotis test is that the reaction at the end of 24 hours' incubation frequently gives some hint as to the type of organism causing the reaction. Approximately 90 percent of our Class 7 reactions were caused by typical aesculin-negative *Streptococcus agalactiae*, the remainder being associated with aesculin-positive streptococci. All but two of 116 Class 2 and Class 5 samples were from quarters infected with streptococci. Most of the Class 1 reactions were caused by staphylococci. A sample showing a high initial pH and falling into Class P on the 24-hour reading almost invariably contained *Pseudomonas aeruginosa*. A majority of the remaining Class P reactions were caused by large Gram positive rods.

For the purposes of routine surveys for mastitis it seems apparent that regardless of which test is used more than one sample from a quarter must be examined before the quarter can definitely be classed as infected or not infected with streptococci. On the basis of our results we recommend the following routine:

1. Set up the Hotis test in the usual manner, i. e., adding 9.5 ml. of the sample to 0.5 ml. of 0.5 percent aqueous solution of bromo-cresol-purple in a sterile test tube.

2. Record the approximate pH (normal, slightly alkaline, or alkaline) of the sample as indicated by the color of the milk-dye mixture.

3. Incubate the tubes at 37° C. for 20 to 24 hours.

4. Classify the reactions according to some convenient system of classification.

5. Prepare Breed smears from all tubes showing doubtful reactions, stain, and examine under the microscope for the presence of long-chain streptococci.

With this routine we are justified in regarding all Class 7 samples as definitely positive for streptococci and needing no further confirmation. According to our results we would be 98 percent accurate if we also regarded all Class 2 and Class 5 reactions as positive. With respect to the 975 samples shown in Table 2 that gave negative reactions with the Hotis test, 6 contained the aesculin-positive streptococci. These 6 infected samples would be missed if we did not prepare smears from all samples negative in the Hotis test. On the other hand, by considering all of these samples as definitely negative and eliminating them from further study, we would eliminate 5 of the 10 false positive smears. Because of this compensating error and because of the relatively minor importance of the aesculin-positive streptococci involved in the error, we feel justified in recommending that negative Hotis reactions be considered as final without the preparation of smears. Likewise, we feel that all Class P and Class 4 reactions may be considered definitely negative.

Because of the acid reactions that occur in Class 6 and the possible confusion of Class 5 samples with this group, we recommend that the few samples that fall into Class 6 be examined microscopically. Also, smears should be prepared from Class M and Class 1 samples.

With this new procedure we were able to detect 100 percent of the samples containing typical *Streptococcus agalactiae*. The test detected 218 (96.8 percent) of the 225 samples from quarters infected with either group of streptococci. Also, it revealed 1203 (99.5 percent) of the 1209 negative samples. Therefore the new procedure shows greater accuracy than has been obtained by other workers either with the original Hotis test or with Bryan's method. Furthermore, if a herd were tested two or three times over a period of a few weeks, the composite

results would be even better than are shown here. The procedure retains all of the advantages of the Hotis test and eliminates, without much additional labor, much of the doubt that has been caused by the "suspicious" reactions.

SUMMARY

1. It has been found by quantitative experiments that the dye in the Hotis test does not retard the growth of mastitis streptococci.

2. With this fact established, a procedure is recommended for interpreting the "suspicious" Hotis reactions by examining a smear prepared from the 24-hour Hotis test.

3. In the examination of 1434 samples from 37 cows the new procedure detected 96.8 percent of the samples from quarters infected with streptococci and 99.5 percent of the samples from streptococcus-free quarters.

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Mr. Abele in New Position

Mr. C. A. Abele, who has been known to the milk industry for many years in connection with his work on milk sanitation in Alabama, has resigned from his former position as Director, Division of Inspection, State Department of Health, Montgomery, Alabama, and has been appointed to be Director, County Dairy Inspection Section, Bureau of Dairy Products, Chicago Board of Health, Chicago, Illinois. He will be located in the new offices of the Board at 54 West Hubbard Street, Chicago. His experience in introducing the U. S. Public Health Service Ordinance in Alabama fits him to apply it in the large Chicago milk shed.

Mr. Abele is being succeeded in Alabama by Dr. Franklin A. Clark, formerly milk specialist with the Public Health Service, and prior to that a member of the field staff of the Division of Inspection, Alabama State Health Department, Montgomery.

Familiarizing Milk Plant Personnel with Sanitary Requirements

S. V. Layson

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The Illinois General Assembly enacted in 1925 a law known as the Milk Pasteurization Plant Act. Chicago had adequate local milk sanitation control and was exempted by the Act. The discussion that follows deals with milk sanitation in the state outside of Chicago, locally known as downstate Illinois.

The adminstration of the Act was placed in the Department of Public Health. This law provided for sanitary control of fluid milk pasteurizing plants including their construction, equipment, maintenance, and operation, but did not give health authorities of the state jurisdiction in the sanitary production of milk. Theoretically, all regulations pertaining to the production of milk were vested in the Department of Agriculture.

"Why is the state so particular about the way pasteurized milk is handled, since at the same time it gives no attention to raw milk?" That is a question which has been asked many times. The answer is that the founding fathers, if we may so speak of those individuals who inaugurated and put in force the sanitary requirements for pasteurization plants, deemed the safeguarding of pasteurized milk supplies the most expeditious way of protecting the health of the greatest number of people.

EARLY CONDITIONS

The pasteurization act of 1925 empowered the Department of Public Health to adopt and enforce minimum requirements for milk-pasteurization plants. During the early years of enforcement, emphasis was placed on a few requirements then regarded as most necessary: thermometers, elimination of dead ends, and use of covers for vats, to name a few. In the light of present-day practice, the methods and means of pasteurization in use at the time of the passage of the law were very crude. For example, it was not uncommon to find small distributors heating milk in the family wash boiler on the kitchen stove. The milk was stirred by hand, if agitated at all. The stirring instrument might be a section of fence picket or the iron spoon used for soap making. Even in the case of some large distributors, the milk might be heated by inserting a steam hose in the vat of milk. The vat was possibly of nondescript lineage. Control of time and temperature were given little or no attention. As a result, the milk frequently had a decided cooked flavor or it had not been adequately heated to destroy disease germs. Milk-borne disease from this inadequately protected milk was frequent.

The type of milk distributor operating under these extremely unfavorable conditions was primarily interested in improving or prolonging the keeping quality of his product, the use of formaldehyde as a preservative having been frowned upon by various governmental agencies and reputable milk distributors in general.

The enactment of the pasteurization law was the result of concerted action by the dairy industry as represented by those distributors concerned for the future of the industry, and by health officials to whom the value of pasteurization as a health protection had been demonstrated.

The accusation that pasteurized milk was a graveyard for germs, and the process was a means of preserving dirty milk, was without doubt, all too frequently justified. Perhaps it was necessary to use drastic corrective measures. At any rate, the early enforcement efforts were the "strong arm" police tactics. "Clean up

or we will close you up." No doubt in some instances "closing up" was the only solution for a dangerous situation. Those familiar with food sanitation know that there are certain individuals who are by nature or temperament unfit to handle food. Today, it is possible to discourage or prevent, by some means or other, such individuals from entering the milk processing field.

The "strong arm" enforcement policy engendered antagonism, and often made enforcement more difficult. If it had continued, it would have been necessary eventually to have a policeman stationed in each plant every operating hour. The need for a change in policy became apparent.

MOBILE LABORATORY

Many plant operators were unfamiliar with plant sanitation and the requirements of the pasteurization act. Education seemed to be needed. As a first step in educating plant personnel, the department equipped and put in the field in 1927, a mobile milk laboratory. It was staffed by two milk bacteriologists who were also trained in milk plant operation. The method of operating the laboratory was to visit pasteurization plants, collect samples for sediment test, methylene blue tests, direct microscopic count, and plate counts, and to make the tests while at the plants. Plant personnel were shown the methods of analysis, and the reasons therefor were explained. Sanitation problems were discussed and solutions suggested. Written reports of the analytical results were sent to the plant owner or operator as soon as they were available. When necessary, corrective measures were recommended in the reports. If results were indicative of satisfactory sanitation in plant methods, the operators were commended and permitted to use the results in promoting wider distribution of pasteurized milk.

When this mobile laboratory service was first started, it was looked upon with suspicion by some plant operators. They had the idea that the health department was prying into their business. But after the first visit, they learned the real nature of the work and thereafter the laboratory was welcome. In a few instances the mobile laboratory served as a policing agent but its principal purpose was educational. After the first year or two, the annual visit of the laboratory was looked forward to by plant operators who were so situated that they did not have laboratory service available.

The mobile unit was continued in service for seven years. It seemed to make plant operators sanitation-conscious, and was the incentive for some of the larger downstate plant operators installing laboratories of their own. It was discontinued because of obsolescence of the equipment and shortage of funds.

MANUFACTURERS' CONFERENCES

From its inception, the Dairy Department, College of Agriculture, University of Illinois, cooperated in this educational campaign. It inaugurated an annual one-week dairy-manufactures short-course to which each milk plant operator in the state was invited and urged to attend. A number of years of the short course work done by the University has demonstrated its incalculable value. Its principal shortcoming has been that it is impossible to get the rank and file of plant operators and their employees to attend. The answer seemed to be that if the plant men would not come to the educational center at the University, it would be necessary to take the training to the plant men.

To put this idea to the test, in March, 1937 the Milk Sanitation Section of the Department of Public Health sent letters to all (about 50) plant operators in a less favored section of the state. A plan for holding a sectional meeting was explained. A return addressed postcard was enclosed with the request that they state their opinion of the plan and give a choice of day of the week and of several proposed locations. An unexpected number of favorable replies was received. No unfavorable ones came in.

The next problem was to choose a location. One particularly enterprising plant operator got his local chamber of commerce interested, and that organization offered to provide a meeting place and

make all arrangements for the accommodation of those attending. Fortunately that town was nearest the center of the area and easily accessible by good roads. Friday was the most favored day of the week.

A program was prepared and mailed to all plants in the section. The mailing again included a return addressed postcard with the request for the number who would attend from each plant. The program was made up of an afternoon session, a trip to a point of interest arranged for by the local chamber of commerce, a moderate-priced evening meal served by a church organization, and an evening session.

Speakers on the program were Health Department staff members and University Dairy Department staff members. The subjects selected for discussion included plant construction and maintenance, equipment and container-cleaning and storage, water supply and waste disposal, operation of pasteurization equipment, and two discussions of commercial interest to plant operators.

The reply cards indicated that about sixty would attend. The actual attendance was 83, representing 29 plants. As judged by attendance, interest, and opinions, the meeting was a success. The results encouraged repeating the plan in other sections of the state.

Experience gained by meetings that followed taught that the afternoon and evening sessions in one day were too long, too concentrated. Men accustomed to the active life of plant work and the early morning hours were prone to doze in spite of a desire to hear the talks and take part in discussions. Through trial and error, a series of three, two-hour evening sessions at each location, held at two week intervals, was finally decided upon as the most practical and serviceable plan.

For the want of a better name, these meetings have been termed "Milk Plant Men's Conferences." In reality they are conferences, because open and free discussion has been encouraged. It has been the aim to select speakers who could talk the plant men's language. Academic discussions have been discouraged. The principal purpose has been to improve plant sanitation and methods, but as a drawing card, each session has included a discussion of some dairy manufactures or products problem of more immediate commercial interest to the plant operator. We have facetiously termed it "Sugar-coated sanitation."

Locations for these conferences have been chosen so that they were readily accessible to all plants within a radius of about fifty miles. This has enabled plant personnel to attend and return home the same day.

In arranging the programs, the aim was to cover each phase of plant operation in logical order during the series. A session usually included two talks dealing directly with plant sanitation. One of these was illustrated by slides and movies. A third was on a subject with a commercial appeal. Time was allowed at the end of each session for discussion. The third and last session in a series included a banquet. As a review and test, a true and false questionnaire was given each person at the banquet.

The ultimate aim is to require certificates of competency for persons in direct charge of operating pasteurization equipment. It is anticipated that this preliminary educational work is laying a foundation for requirements which will be sufficiently rigid to mean real competency in plant personnel. A new pasteurization law was enacted in 1939 to replace the act of 1925. This new law makes it a misdemeanor for plant operators to employ careless, indifferent, and inefficient personnel. The results of this legislation are to be revealed by the future.

SUCCESS OF PROGRAM

Since the beginning of this type of educational work, forty-one sessions have been held in eighteen sections of the state. Practically every plant operator and his employees have had an opportunity to attend by driving not more than fifty miles on paved highways. It has frequently happened that after attending a conference in his district, a plant oper-

ator has sent employees to meetings in other nearby sections.

One of the most noticeable effects of this work has been the improvement in attitude of plant employees who have attended the conferences toward sanitarians when making routine inspections of the plants. By questions and discussions of their particular problems at the time of inspections, they have shown an increased desire to improve their skill and methods. These employees no longer regard the sanitarian as a policeman from whom they should hide defects but rather as a person who is ready and willing to help with their problems.

Summing up the results from all conferences reveals that 2,937 pasteurization plant employees attended from 368 plants out of the 460 on record at that time. Persons representing local health agencies, equipment and supply firms, and other miscellaneous interested groups attended the forty-one sessions to the number of 332. The plant employees included route men as well as persons actually working in the plants. The route men were attracted by subjects including moving pictures designed to make them better salesmen.

The invaluable assistance of equipment manufacturers is gratefully acknowledged. They supplied apparatus for demonstration purposes, such as valves, fittings, and air space heater assemblies. Municipal health authorities gave unstintingly of their time and effort in carrying out the programs held in their communities. The University of Illinois, Department of Dairy Husbandry, provided speakers on technical subjects. The International Association of Milk Dealers lent their sound slide films dealing with selling problems. The Illinois Dairy Products Association provided speakers on a number of the programs. All of these groups contributed materially to any degree of success which this educational campaign has attained.

Mr. Estes, Market Administrator

Mr. Howard R. Estes was appointed Market Administrator, Flint, Michigan, on January 27, 1940.

For a long time, Mr. Estes has been well known in the field of milk sanitation and technology. He graduated from Michigan State College, taking the degree of Master of Agriculture, and was appointed as Dairy and Food Inspector in Flint, and became Chief Inspector in 1920. He resigned to become staff associate in the American Child Health Association and then accepted the position of Chief Sanitarian, Research Laboratories of the National Dairy Products Association, later Production Manager of the Artic Dairy Products Corporation, Detroit.

He has been active in the International Association of Milk Sanitarians, and was president for the term of 1928-1929.

He will bring to his new duties a breadth of experience in all aspects of the dairy industry. He is also thoroughly experienced in handling the intricacies of official procedure and public relations.

A Rapid Multiple Color Test for the Approximation of Available Chlorine * †

Harry Scharer

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Department of Health, New York City

In recent years, many new reagents or combination of reagents have been proposed for the determination of available chlorine. This work, both in this country and abroad, has been mainly directed toward the qualitative and quantitative determination of this halogen in potable water supplies. Little attention apparently was given to the application of new procedures to the rapid determination of chlorine in the range of concentrations normally required for rinsing or sterilizing solutions which vary from 10 to 500 p.p.m.

One of the most commonly accepted methods is the tiltrimetric method using the well known starch-iodide, sodium thiosulfate technique (1) together with its many modifications (2, 3, 4, 5, 6). Generally speaking, such methods are not readily applicable to field work either because of the complexity of the mechanics involved or the amount of apparatus required.

Consequently, the methods most in vogue in plant testing are colorimetric, the determination being made by adding an indicator to the chlorine solution and matching the color obtained against a series of standards. This group includes benzidine (14) and o-tolidine (12) which yield yellow colors, dimethyl p-phenylene diamine (p-amino dimethyl-aniline) hydrochloride, (7, 8, 9, 10) yielding red or purple colors, tetramethyl para-phenylene diamine giving violet colors, (7, 10) the fuchsin sulfate test yielding yellow colors, (11), hexamethyl tri-p-aminotri-phenyl methane yielding violet colors, (13) and many tests of similar nature.

Since most of these reagents and methods are nonspecific for chlorine and react with other oxidizing agents, interferences from certain other ions are frequently encountered. These interferences are of more moment when dealing with low chlorine concentrations such as are used in water treatment than when high concentrations are encountered such as the 10 to 500 p.p.m. commonly required of the dairy industry.

A limitation of most colorimetric determinations of chlorine is that the chlorine solution must be diluted considerably in order to bring the concentration within certain effective limits of the indicator. Thus it is stated in the Standard Methods of Water Analysis (1936) that "beyond 3.5 to 4.0 p.p.m. chlorine, o-tolidine colors become erratic in hue and subject to rapid changes in intensity. Concentrations of chlorine as high as this do not appear to be susceptible to accurate determination with o-tolidine unless previously diluted." Where an o-tolidine field test provides a single color standard and requires the dilution of the chlorine solution to the level for which the standard is provided, the accuracy of the determination depends on the competency with which the aliquot for dilution is taken. Furthermore, since the dilution must be such as to be within the effective limits of the indicator as stated above, there may be an effect from interfering ions. From the standpoint of plant or field testing a

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* Publication authorized by John L. Rice, M. D., Commissioner, Department of Health, New York City.
This paper was prepared as the result of an assignment by the Bureau of Food and Drugs of the Department of Health of the City of New York. The problem was worked on as part of the regular duties in the Department, and in association with other workers of the Chemical Laboratory and Milk Inspection Divisions.
† Presented before the 13th Annual Meeting of the New York State Association of Dairy and Milk Inspectors, Syracuse, September 27-29, 1939.

greater limitation to the o-tolidine test is the necessity of waiting about five minutes for the full development of color, and the difficulty of matching yellow colors particularly under artificial light.

Early this year, we undertook the task of developing a suitable field test for available chlorine that would possibly overcome some of the objections to existing tests, give distinctly different colors at varying degrees of chlorine concentration, and be rapid and simple. The literature is replete with observations that certain diamino compounds when oxidized give blues and yellows, and of the combinations that these two colors would produce, but in every instance the colors were described as "fleeting." In the o-tolidine test, special precautions are suggested to prevent the formation of these "interfering" colors; in fact, it was several years before the method was standardized so as to prevent the troublesome variations.

In "A potentiometric and spectrophotometric study of meriquinones of the p-phenylene diamine and the benzidine series" (15) in which the phenomenon was investigated from the oxidation-reduction angle, the suggestion was made that "there are several conditions to be met if an oxidant is to induce a definite color; and, conversely, by variation of these conditions the potential necessary can be made to vary . . . . Consequently there arise two questions of importance to analytical chemistry: First, has the enormous amount of labor expended upon the empirical standardization of certain use of these reagents established the conditions within which reproducible results can be obtained? Second, is it worth while to apply to these precarious reagents the logical standardization of conditions which our equations implicitly outline?" Then applying that reasoning to the o-tolidine test, the authors stated that "a return to the blue color test would be useful in the examination of colored water . . . and could now be logically designed, *but it is improbable that the specifications would be simple enough for field use.*"

An investigation of a number of amino and diamino compounds was accordingly undertaken by us, to ascertain the suitability of this type of compound as a test for chlorine under certain prescribed experimental conditions. From an academic standpoint, the investigation eventually yielded several suitable reagents, but the solubility of some were such as to render them unsuitable for a field test, whereas others were not commercially available or were available only at a prohibitive price. For pragmatic reasons, the technique was then re-designed to utilize a salt of 3,3′ dimethyl benzidine (o-tolidine) since this compound was readily prepared.

BASIS OF TEST

The test which we now propose is predicated upon the reactions of o-tolidine dihydrochloride with chlorine which first yields a meriquinone of o-tolidine (blue colored) and eventually yields the holoquinone of o-tolidine (yellow colored) as illustrated by the chart on page 86.

We found under the pH conditions described *infra,* that when the gravimetric ratio of the o-tolidine dihydrochloride to available chlorine was approximately 10 to 1, a blue color was obtained and as this ratio was decreased through the increase of chlorine, other colors were formed as indicated in Table 1.

TABLE 1.

Ratio of o-tolidine dihydrochloride to available chlorine	Color
10 to 1	blue
10 to 2	green
10 to 3	yellow
10 to 4	orange

Although intermediate colors were formed by intermediate ratios, the colors outlined above are sufficiently distinct as to be readily differentiated. A ratio of 20 to 1 yielded a pale blue instead of the bright blue given by the 10 to 1 ratio. A maximum of 500 gamma (0.5 milligram) of the o-tolidine dihydrochloride seemed to give the best color changes. Aluminum salts were initially used to produce brilliant and lasting colors but were subsequently replaced by the procedure following:

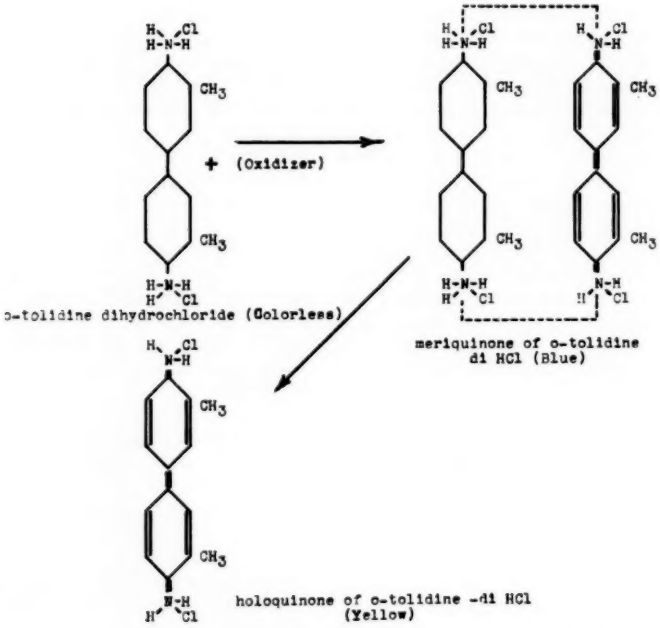
(Oxidizer)
o-tolidine dihydrochloride (Colorless)
meriquinone of o-tolidine di HCl (Blue)
holoquinone of o-tolidine -di HCl (Yellow)

FIGURE 1.
Reaction of o-tolidine HCl with chlorine

THE MULTIPLE COLOR FIELD TEST

Preparation of reagent:

Dilute 15 ml. of glacial acetic acid to 100 ml. with distilled water. Add 6.8 grams of sodium acetate crystals ($NaC_2H_3O_2.3H_2O$). Shake until dissolved.

Dissolve 50 milligrams of o-tilidine dihydrochloride *crystals* in 50 ml. of the above solution. This compound, when of proper purity and manufacture, is readily soluble. Store in a light-proof (brown) bottle. Keep tightly stoppered when not in use, and protect from direct sunlight. The stability of this solution depends on the purity of the reagent. For best results, the solution should be prepared semi-monthly or weekly.

Apparatus:

Test tube—calibrated at 10 ml. and 4 ml.
Pipette—calibrated to deliver 100 gamma available chlorine at concentrations of from 50 to 500 ppm.
Dropper—calibrated to deliver 0.5 ml.

Method:

When 0.5 ml. of the above reagent is added to the following quantities of chlorine, characteristic colors are produced, as for example:

50	gamma	(10 ml. of 5 ppm.)		=blue
100	"	10	"	=green
150	"	15	"	=yellow
200	"	20	"	=orange

TESTING PROCEDURE

To test any chlorine solution, take an amount of the chlorine solution equal to 100 gamma available chlorine (as judged by presumed strength), dilute to 10 ml. with unchlorinated water, add 0.5 ml. reagent, and shake briefly. Color forms within ten seconds.

Blue = too weak
Green = satisfactory
Yellow = strong but effective
Orange = too strong

To calculate the number of ml. of chlorine solution required to give 100 gamma, divide 100 by the presumed strength in ppm.

Examples:
100÷ 25 ppm.=4 ml.
100÷100 ppm.=1 ml.
100÷250 ppm.=0.4 ml.

These quantities are then diluted to 10 ml. for testing purposes.

It should be noted that there is no sudden change in color but a gradual blending of one color into the next. For that reason, we are suggesting as permanent standards to be used with the test, transparent colored plastic sheets which have been matched to the actual test colors. These colors are stable for a considerable period but preferably should be viewed within a few minutes. The test is directed at a practical approximation of the strength of any hypochlorite solution. With chloramines, the color formation is slower; initially a blue color is formed in all instances which then gradually (about two minutes) shifts through the range of other colors according to the amount of available chlorine present before becoming stable at the proper color. In a sense, this affords a method of distinguishing between a hypochlorite and a chloramine solution. While the application of the test to chloramines has not been fully studied, indications are that the addition of a sodium chloride solution to the 10 ml. dilution of chloramine in the test will greatly speed the quinone color formation.

These color reactions rest on the oxidizing capacity of chlorine, therefore interferences may be expected with certain ions such as ferric, nitrite, and manganic ions just as with existing colorimetric tests. The influence of such interferences has not been completely investigated although it is unlikely that they would interfere materially in the dilution used (10 ml.) and the concentrations of chlorine concerned (50-200 gamma).

While the test as described is only an approximation of the available chlorine, the accuracy of the determination can be increased by repeating the test with the substitution of 0.4 ml. or 0.6 ml. of reagent for the 0.5 ml. prescribed. With the smaller amount of reagent, we would expect a shift toward the yellow side, assuming we had initially obtained a green; while with 0.6 ml. of reagents, we would expect a shift toward the blue end of the color range. With this type of manipulation, it is possible to narrow greatly the limits of approximation and render the test even more accurate and useful.

Further work is in progress regarding the application of the technique to the testing of chlorinated water supplies and of chlorination of sewage. This will be described in a subsequent paper.

SUMMARY

A colorimetric test for the approximation of available chlorine is presented based on the formation of a meriquinone and a holoquinone of o-tolidine dihydrochloride and their intermediate products. Dependent on the level of chlorine concentration, the method yields four distinct colors which can readily be differentiated. It is simple, rapid, and inexpensive, and will distinguish between a hypochlorite and a chloramine.

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A Survey of Mastitis Control Under Several Plans *

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In order to compare the values of two methods in use for the laboratory examination of milk samples for the detection of mastitis and abnormal secretion, with the value of physical examination of dairy cows, surveys have been made in several representative communities (1) of typical methods of laboratory control, and (2) of combinations of laboratory control and occasional physical examinations, and (3) of plans of control under which well supervised physical examination of herds have been maintained by full-time veterinarians employed by local health departments, by full-time company veterinarians, or by practicing veterinarians engaged by local health departments or owners to examine the herds.

EXAMINATION

Practically all cows included in the study were examined by the writer within three hours after milking while the udders were empty and at their greatest period of rest. Very few were examined with full udders. Throughout the survey, a technic of examination was used identical to that followed in the examination of herds during investigations of milkborne epidemics, or during routine examinations of herds producing milk to be pasteurized as Grade A, Grade B, or to be bottled and sold as Certified, Special A, or Grade A Raw. This included, besides the palpation of the udder, the examination of the secretion from each quarter by the brom thymol blue test. Cows classed as "rejected" would be designated as Class 3 and 4 cows under the Udall plan of udder classification. In our routine examinations, such cows are removed from the milking herd by official segregation for a period of sixty days or less pending reexamination. It is our policy not to condemn cows except under very exceptional conditions, and only with consent and agreement of the owner and local health representatives.

The six plans of control included in the study are described as follows:

CONTROL PLAN A

Under Control Plan A, the method of supervision and control was entirely by the laboratory. Official street samples of bottled milk of pasteurized A and B, Grade A Raw, and other grades of milk and cream were taken every three months. The standard agar plate method of analysis was used for examination of pasteurized milk and cream. However, sediments from centrifuged samples were examined for the presence of streptococci and leucocytes. The direct microscopic method of examination was also used on centrifuged raw milk and cream samples. Under this plan when evidences of mastitis were discovered by direct microscopic examination as indicated by long chain streptococci or excessive leucocytes, an inspector was directed to obtain individual quarter samples from all milking cows in the herd. If streptococci or excessive leucocytes and phagocytosis were discovered by examination of individual quarter samples, the owner was then advised to remove the cow from the milking herd or to discard the milk from the diseased or suspicious quarters, and was requested to submit occasional follow-up samples to the laboratory for direct microscopic examination, to determine when and if the animals had recovered.

When milk from the diseased or suspected quarters was determined by the laboratory to be free from streptococci or evidences of pus, the animal was consid-

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ered again to be satisfactory for the production of milk. No physical examinations were made of diseased cattle by a veterinarian before returning them to the milking herd, neither were laboratory or physical examinations required for cows being added to the herd as replacements or as purchased additions. It should also be interesting to know that practically all cows under observation in Plan A were purchased from professional cow dealers and that practically all herds were completely replaced every six months.

The results of the survey of conditions under Plan A appear in Tables 1 and 2.

Correlation comparisons of results of physical examination and laboratory findings appear in Table 2. Only cows are included in this correlation from which both the results of physical examination and laboratory findings were available. These laboratory tests were made on samples from individual quarters, not on centrifuged samples from bottles.

These results under Plan A show that 36 percent of the cows examined were infected with mastitis. Of these, 19 percent showed symptoms of distinct clinical mastitis and were unfit for milk production. Laboratory examination of street samples of bottled milk revealed streptococci in only three samples. Each of these bottles of milk came from a dairy where a very large percentage of the cows showed acute or chronic clinical mastitis. Even when samples of milk from individual quarters were examined for streptococci, the results revealed only 51 percent of the abnormal cows. (Table 2.)

The results indicate that this method of supervision, i. e., by the examination for streptococci of centrifuged samples of bottled milk, is of no practical value in detecting abnormal milk or locating cows suffering with mastitis, and should not be accepted as an approved control method.

TABLE 1

Results of Physical Examinations of Cows Under Control Plan A

Total number of herds examined		25
" " " cows	"	828
" " " "	normal	526 or 64 percent
" " " "	suspicious	143 or 17 percent
" " " "	rejected	159 or 19 percent

CONTROL PLAN B

Under Plan B, a more comprehensive program of laboratory control has been carried on since 1935. The plan consists of an annual brom thymol blue test on milk from quarters of all cows, augmented by a bimonthly examination of can samples of milk as delivered by each producer at the plant. These can samples are taken to the laboratory where they are placed in refrigeration over night. They are examined the following day for sediment, off color, and for direct microscopic examination. When evidences of mastitis are obtained as indicated by streptococci or excessive leucocytes a check

TABLE 2

Total number of cows classed as "Rejected" upon physical examination	148
Total number of cows classed as "Suspicious"	86
Total number of abnormal cows (rejected plus suspicious)	234
Number of these cows (234) classed as abnormal by laboratory results	119 or 51 percent
Number of rejected cows found abnormal by laboratory results	91
Number of suspicious cows found by laboratory results	28
Number of cows classed as "Normal" by laboratory test and rejected upon physical examination	57
Number of cows classed as "Normal" by laboratory and suspicious upon physical examination	58
Number of cows classed as "Normal" by laboratory and "Abnormal" by physical examination	115 or 49 percent

test is made at the dairy farm by obtaining individual quarter samples for direct microscopic examination. If evidences of mastitis are found or abnormal secretion is detected, the owner is advised to discard the product of the diseased quarter or to removethe cow from the milking herd. As long as the cow remains in the herd, occasional recheck samples are taken by the milk inspector or are submitted by the owner for direct microscopic examination to determine the progress of the disease in the animal.

Under Plan B, no force or coercion is used to obtain enforcement nor are the owners required to follow out some radical or impractical method of segregation. Instead, determined and constant effort has been made to obtain cooperation from the dairyman by stressing the economical phase of mastitis as it may affect production of the herd and damage the quality of the milk. In addition, public health reasons are explained and the owners are being encouraged to raise replacement cows and to avoid purchase of any necessary replacement animals from professional cow dealers.

In fairness to this method of control, it seems only reasonable to advise you that many cows in the herd and in the milking line, reported as rejected or suspicious on physical examination, were at the time of examination not being milked, or at least their milk was not included for the plant, but instead was discarded or fed to other live stock. However, in order to follow one general plan of reporting all diseased animals in the herds and on the milking line, they are included. The weakness of Plan B control is that permanently diseased or suspicious cows should be removed from the herd or properly segregated from the milking line.

TABLE 3

Result of Physical Examination of Cows Under Plan B
Group B 1. Control entirely by laboratory method

Total	number	of	herds	examined	26
"	"	"	cows	"	454
"	"	"	"	normal	343 or 76 percent
"	"	"	"	suspicious	69 or 15 percent
"	"	"	"	rejected	42 or 9 percent

TABLE 4

Group B1. Result of Laboratory Examinations for 1938

Total	number	of	can	samples	(bi-monthly)	3483
"	"	"	"	"	under 100,000 DMC	3397 or 97.5 percent
"	"	"	"	"	100,00 to 400,000 DMC	31 or 0.9 percent
"	"	"	"	"	400,000 to 2,500,000 DMC	42 or 1.2 percent
"	"	"	"	"	over 2,500,000 DMC	13 or 0.4 percent

On can on April 28 showed evidences of mastitis streptococci.
One can on November 8, 1938 and one can on November 9, 1938 showed evidences of mastitis streptococci.

TABLE 5

Group B 2. Result of Physical Examination
Control by Laboratory Methods as for Group B1 and in Addition
These Herds Had One Annual Physical Examination

Total	number	of	herds	examined	33
"	"	"	cows	"	358
"	"	"	"	normal	273 or 76 percent
"	"	"	"	suspicious	47 or 13 percent
"	"	"	"	rejected	38 or 11 percent

TABLE 6

Total number cans sampled	2731	
" " " less than 100,000 DMC	2632	or 97 percent
" " " 100,000 to 400,000 DMC	25	or less than 1 percent
" " " 400,000 to 2,500,000 DMC	70	or 2 percent
" " " over 2,500,000 DMC	4	or less than 0.05 percent

No can samples showed evidence of mastitis. The follow up check of herds by laboratory method under control Plan B.

TABLE 7

Total number of cows from which samples were taken at the farm..	971	
Total number of such cows indicated to be abnormal.....	52	or 5.3 percent
Total number of quarter samples collected.....	3858	
Total number of quarter samples abnormal.....	75	or about 2 percent

Under Plan B 3, groups of herds were examined. Two of the groups received their control entirely by the laboratory method described, whereas the other group in addition received an annual physical examination by a local veterinarian employed by the milk company. The results are summarized in Tables 3 to 7 inclusive.

These results show no significant difference between the herds controlled by laboratory examination alone and the herds receiving in addition an annual physical examination. Although our physical examination classed from 9 to 11 percent of the cows as rejected and 13 to 15 percent as suspicious, it is quite likely that the laboratory analysis of samples of milk from cans would have shown many more cans containing streptococci or evidences of mastitis had the milk been included from diseased cows. There appears to be a very close correlation between this type of laboratory supervision and physical examination, especially had diseased cows not being used been removed from the herd. It is interesting to note that under Plan B, 98 percent of the can samples of milk gave a direct microscopic count of below 100,000 indicating a high quality milk before pasteurization.

CONTROL PLAN C

Under control plan C, there were two groups of herds, one designated as C-1, the other as C-2.

Herds under Plan C-1 receive semi-annual physical examinations by a local veterinarian, employed by the city health department on a fee basis. In addition to physical examination semi-annually, laboratory samples are submitted for direct microscopic examination from all quarters showing positive brom thymol reactions. When cell counts on street samples of pasteurized milk are found to be over 100,000, can samples are taken at the plant for direct microscopic examination. If indications of mastitis are revealed as indicated by streptococci or excessive leucocytes, the herd is reexamined by the local veterinarian. The results are summarized in Tables 8 and 9.

Under plan C-2, semi-annual physical examinations are made by company veterinarians while general supervision of quality control for herds and plant are carried on by the company's dairy field service men. When abnormal conditions are discovered at the dairy, or the city health department has information indicating abnormal milk, the local milk inspector conducts inspections at the farm. Occasionally, when evidences of mastitis are discovered, a local veterinarian may be employed by the health department to conduct reexaminations of the herd. Sometimes, however, the reexaminations of the herd are conducted by veterinarians representing the milk company.

Briefly summarizing the results of physical examination under plans C-1 and C-2, the results indicate but little disagreement. In fairness to this plan of control, it should be said that in both groups of herds, the worst herds under supervision were examined. The local inspector,

TABLE 8

Results of Physical Examinations of Herds Under Plan C-1

Total	number	of	herds	examined	27
"	"	"	cows	"	462
"	"	"	"	normal	366 or 79 percent
"	"	"	"	suspicious	37 or 8 percent
"	"	"	"	rejected	59 or 13 percent

knowing the past history of each herd, and knowing that the survey must be limited, requested the examination of those herds with the worst known records. It is quite likely that a more extensive survey would have reduced the percentage of abnormal cows.

Another item worthy of mentioning out of justice to the inspector responsible for this plan of control, is that it was impossible to obtain a sufficient amount of laboratory service to be of any great value to this plan of supervision, even though there should be an adequate laboratory service from a county laboratory.

CONTROL PLAN D

Herds under control plan D are used for the production of milk for New York City Grade A pasteurizing plants.

The method of control is primarily under New York City supervision, assisted by plant field inspectors and company veterinarians. In addition to biannual physical examinations by company veterinarians, routine samples of milk are collected at the receiving deck for standard agar plate and direct microscopic examination as regularly required for milk purchased on a premium basis. When abnormal milk is discovered or evidences of mastitis are detected, the dairy farm inspector is directed to make an inspection to determine, if possible, the cause for the abnormality. When evidences of mastitis are discovered, a company veterinarian is directed to follow up the inspector's report and conduct a physical examination of the herd. The survey results are summarized in Table 10.

Due to the fact that milk is sold to the plant on a premium basis, the farmers are alert and make every effort to detect mastitis early in order to avoid losing their premium. It was common to find in this group of herds many cows from which the milk was not being used even though they were still in the milking herds. The owner or milker having detected evidences of mastitis or abnormal milk, had removed the cows from the supply going to the plant. Had they been properly segregated, such animals would not have been included in these results and the rejected cows would have dropped to 5 or 6 percent.

TABLE 9

Results of Physical Examination of Herbs Under Plan C-2

Total	number	of	herds	examined	22
"	"	"	cows	"	420
"	"	"	"	normal	310 or 74 percent
"	"	"	"	suspicious	63 or 15 percent
"	"	"	"	rejected	47 or 11 percent

CONTROL PLAN E

Under control plan E are included about 25 percent of our Special A Raw

TABLE 10

Results of Physical Examination of Herbs Under Control Plan D

Total	number	of	herds	examined	23
"	"	"	cows	"	496
"	"	"	"	normal	403 or 81 percent
"	"	"	"	suspicious	42 or 9 percent
"	"	"	"	rejected	51 or 10 percent

dairies all examined since November 1938. These herds are required to be free from Bang's disease and to be subjected to physical examinations every three months. Some of these herds are examined by a full-time county employed veterinarian; others, by a full-time veterinarian who occasionally examines herds under special conditions, and checks the work of a practicing veterinarian who has been employed by the owner to make the examinations; another group is examined quarterly by a full-time city veterinarian; still another group of these herds is examined by a part-time veterinarian employed as local milk inspector, but employed by the herd owners to make the quarterly physical examination; and the remaining herds are examined by veterinarians employed by the village or by the herd owner.

All these herds have been examined by the writer from two to three times during the last three years. Some herds are receiving satisfactory supervision, particularly under certain veterinarians. These herds have made satisfactory progress and have but very little mastitis or other objectionable infections. Some of the herds, however, have not made satisfactory progress. The fault apparently lies in poor supervision and direction by the county or city department of health, either in accepting carelessly made physical examinations and incomplete and improper reports of examinations and tests of herds, or in failing to make a concerted effort to receive satisfactory cooperation from the dairymen in carrying out a satisfactory plan for herd supervision.

Supervision by the State Department of Health has been gradually stepped up, and unless several of the dairies included in this group show definite improvement, it may become necessary for the Department to withdraw from certain dairies approval of permits for the sale of this grade of milk.

A summary of our survey results is given in Table 11.

It is apaprent that even with four physical examinations annually, the average percentage of normal, rejected, and suspicious cows was about the same or slightly worse than other groups included in the survey report, excepting the herds under Plan A.

Since the last examination of some of the herds reported under plan E, one dairyman with a herd of 191 cows and one dairyman with a herd of 34 milking animals have discontinued the production of Special A Raw milk because of their inability to control mastitis and other infections among the herd.

Under this plan of control, where rigid supervision and good physical examinations have been maintained, and where the veterianrian and the milk inspector have worked together in attempting to obtain satisfactory cooperation from the dairyman, entirely satisfactory results are being obtained.

TABLE 11

Results of Physical Examinations of Herds Under Control Plan E

Total	number	of	herds	examined	38
"	"	"	cows	"	1,007
"	"	"	"	normal	695 or 69 percent
"	"	"	"	suspicious	200 or 20 percent
"	"	"	"	rejected	112 or 11 percent

CONTROL PLAN F

Under plan F, the herds of certified dairies which in most instances are large, are examined at least monthly by a veterinarian employed by the dairy whose professional obligation is to promote methods of control which will prevent the spread of mastitis or other infections. Many of these dairies are under the direct supervision of Kings County Medical Milk Commsision, employing a full-time veterinarian who occasionally examines the herds. His duty is to supervise production of milk, to encourage the dairyman to

TABLE 12

Results of Physical Examination of Herds Under Control Plan F

Total	number	of	herds	examined	6
"	"	"	cows	"	867
"	"	"	"	normal	663 or 73 percent
"	"	"	"	suspicious	186 or 21 percent
"	"	"	"	rejected	18 or 2 percent

maintain satisfactory methods for the production of certified milk, and to advise relative to sound methods of sanitation for the plant and the herds. He is given authority to see that certified regulations are met and that dairies which violate regulations cease to produce and distribute milk or cream under the label of certified.

In addition to monthly physical examination of cows in the milking line, all replacement cows added to the herd and all additions are given a rigid physical examination by the farm veterinarian before being admitted to the milking herd.

All animals removed from the milking herd because of mastitis or other diseases are subjected to a physical examination by the farm-employed veterinarian before being readmitted to the milking herd, and in addition, samples of milk obtained from individual quarters of all suspicious cows are examined on blood agar plates for evidences of hemolytic streptococci or staphylococci before being readmitted to the milking herd. Strip cups are required to be used at each milking. Our survey of these herds is summarized in Table 12.

SUMMARY

A grand summary of the results of physical examination of all groups of herds under the various plans is shown in Table 13.

This general comparison indicates that Plan A has but little value at all in detecting diseased cows or abnormal milk. This is no reflection on laboratory control, but on the methods selected in this plan.

Under the other plans, there is a very close relationship between normal, suspicious, and rejected cows except under Plan F.

The data indicate that good physical examination of herds once or twice annually using the brom thymol blue test and good control by laboratory methods using the direct microscopic method of bi-monthly examination of can samples of milk, gave very satisfactory results.

The control under plan F where all cows found infected and showing clinical evidences of mastitis by physical examination are removed from the milking herd seems to indicate that it is essential to remove actively infected cows from the milking barn and keep them entirely away from the milking cows and not allow such cows to enter the herd again unless they are known to be free from active infection.

A complete analysis of all data obtained during the progress of this survey

TABLE 13

Total	number	of	herds	examined	200
"	"	"	cows	"	4892
"	"	"	"	normal	3579 or 76 percent
"	"	"	"	suspicious	787 or 16 percent
"	"	"	"	rejected	526 or 11 percent

	Normal	Suspicious	Rejected
	%	%	%
Plan A	64	17	19
Plan B (1)	76	15	9
Plan B (2)	76	13	11
Plan C (1)	79	8	13
Plan C (2)	74	15	11
Plan D	81	9	9
Plan E	69	20	11
Plan F	77	21	2

and of other observations made at the dairy farms shows the necessity for a closer cooperation between the laboratory and veterinary supervision, and that either method will produce satisfactory results in detecting mastitis if properly and diligently applied. The lack of good sanitary control of herds and barns, inadequate use of bedding, purchase of additional cows from infected sources, overfeeding for high production, and failure to eliminate sources of injury to cows, all contribute to the spread of infection.

Laboratory methods of control or veterinary supervision carried on in a haphazard manner is of practically no value and should not be permitted by health officers or health departments. To obtain satisfactory supervision requires a long range, well-directed plan applied by well-trained representatives of health departments, including a program of educating the farmer in dairy farm sanitation and animal husbandry.

DISCUSSION

Mr. Rothery: There is no doubt that Dr. Graves has put in a lot of time and work on his survey and has given us much information. To me the object of the survey was to determine the best plan for the control of mastitis. I find that while he has carefully explained the various plans and given us the results of his examinations of the herds, he has very carefully avoided giving us any definite conclusions or made any recommendations.

I believe the object of this survey was definitely to establish whether or not we could control mastitis (1) by laboratory examinations, (2) by physical examinations by a veterinarian, or (3) by a combination of physical and laboratory examinations.

Plan A did not work very well for control. You will note that 19 percent of the cows were rejected, and only 64 percent were normal. Another interesting feature under this plan was the instructions of the inspectors to put the milk from the diseased or suspicious cattle in the pasteurized milk supply and the milk from the best cows in the "Grade A Raw." How many times during the survey did we have something similar quoted to us by the producer—"According to Geneva no one has ever been hurt by mastitis milk after pasteurization". Not only was this argument used by producers but by men standing high in the dairy industry. Our only answer to this argument is that the Code does not allow abnormal milk or milk from diseased cattle to be used whether it is pasteurized or not. Every producer, large or small should be educated to this idea.

By figuring Dr. Graves' summary in a different manner and averaging the different sub-plans, we get the following results:

Under Plans E and F, the relation of the "rejects" is out of proportion to the "suspects." We believe that these suspicious cows are border-line cases, and that in herd examinations, where one-fifth or more of the cows are "suspects," a good proportion of these will be "rejects" on the next examination. Under Plan F, where monthly examinations are made and 2 percent are "rejects," the figures for the year would be 24 percent "rejects." Under Plan E, where the "suspects" run 20 percent, the figures for the "rejects," with four examinations a year would be 44 percent. Under Plan C, with twice a year examination, your percentage of "rejects" is 24 percent. Under Plan D, with two physical examinations a year, only 18 percent are suspicious and 20 percent "rejects."

By this method of comparison, it looks very much as if Plan D is the most effective in its control. This plan provides

Plan	Normal	Suspicious	Rejects
A	64	17	19
B	76	14	10
C	77	11	12
D	81	9	10
E	69	20	11
F	77	21	2

two physical examinations a year, bimonthly examination of each producer's milk by the microscopic method, and prompt following up by inspectors and the veterinarian.

Before concluding this discussion, I would like to call your attention to the difficulties of some of the examining veterinarians. At present, one of the main ones is caused by the veterinarian who tells the farmer he can cure mastitis, even "rejects," and to prove he has worked a cure, uses two drops of brom thymol instead of one-half cc. How are we going to control this type of veterinarian.

Dr. Brooks: Dr. Graves used three different terms "rejected," "infected" and "bad." What does he mean? Also will he please tell us the basis on which he considers a cow suspicious? Also in his Plan A, was laboratory control by the plate method only? I was rather surprised and a little disappointed that the results with the Special A Raw herds were not better. In studying Dr. Graves' figures, I wonder if the method used makes so much difference as how hard you work at it.

Dr. Graves: The terms "bad," "infected" and "rejected" are used synonymously. In Plan A in addition to plate counts on pasteurized milk, direct microscopic examinations of centrifuged samples were made.

Dr. Brooks: What is the condition of a *bad* cow?

Dr. Graves: A normal cow's milk is strictly normal on brom thymol test and physical examination, and there is no lack of symmetry, induration, or change in the quarters. Suspicious cows give slight reactions on brom thymol test and show slight indurations and some atrophy on palpation. Whenever I find the milk from any quarter bloody or stringy, or get a decidedly positive brom thymol test on the milk from any quarter, or when I find extensive indurations and atrophy in the udder, that cow is a bad cow and should be rejected.

(Other papers in this symposium will be published in the May-June issue.)

B - K Founder Dies

At the age of 84 years, Mr. Arthur O. Fox, pioneer in the commercial development of chlorine bactericides, died at his home in Madison, Wisconsin, on December 11. He early urged the use of hypochlorites, and he lived to see the use of products of this type in hospitals, homes, and commercial plants. The company for the manufacture of B-K was organized by Mr. Fox in 1911. It was first known as the General Purification Company, then changed to General Laboratories. For the past ten years it has been a division of the Pennsylvania Salt Manufacturing Company of Philadelphia.

The president, Mr. L. T. Beale, announces that Mr. R. L. Davies has been appointed manager of the newly established Market Research Department.

The Voluntary Grading of Milk Supplies in Alabama

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At the annual convention of this Association in Atlantic City, N. J., in 1936, Mr. C. A. Abele, then Director of the Division of Inspection, Alabama State Department of Public Health, read a paper entitled "Milk Control in Small Communities on a Mandatory Versus a Voluntary Basis". During the discussion of this paper, Mr. Leslie C. Frank, Senior Sanitary Engineer, U. S. Public Health Service, expressed the desire that further study be made of the voluntary grading system in small communities in Alabama, in the hope that an answer to the vexing problem of milk control in small communities might be found. This paper does not present a complete answer to this problem; however, it does present the results of the voluntary grading plan in the eleven Alabama communities in which this system is now in effect. From this experience, certain conclusions may be drawn.

REGULATORY DIFFICULTIES

Most of the members of this Association know that the U. S. Public Health Service Milk Ordinance was first put into effect in Alabama in 1923. Our state has been known since that time as a "Standard Ordinance State", and all milk control work, with the exception of that done in the City of Birmingham and other communities in Jefferson County, has been patterned after the U. S. P. H. S. Milk Ordinance and Code. In our zeal to bring the benefits of milk control to as many communities as possible, we were instrumental in having the City Councils of some communities under 5,000 in population adopt the Standard Ordinance. All went well, and we were well pleased with our efforts, until such time as it became necessary really to enforce the ordinance in these small communities. Then we learned that in most of these communities, the mayor, a member of the city council, the city marshall, or some relative, owned family cows, and were themselves selling to friends and neighbors. We also encountered a reluctance upon the part of city officials to prosecute violators of the milk ordinance. Surveys in these small communities revealed that in many, and perhaps I should say most, instances, the graded commercial supplies constituted a very small percentage of the total volume of milk marketed, both commercially and in this way.

VOLUNTARY GRADING PROVISION

In 1934 we were provided the means whereby the unauthorized use of grade designations could be stopped. The State Milk Regulations, adopted by the State Board of Health that year, included a provision that: "It shall be unlawful to use on bottles or other containers of milk or milk products sold in . . . . County, any caps or other device bearing any legend indicating that the contents have been graded in accordance with the provisions of these regulations, unless the contents have been graded and the producer or distributor holds an unrevoked permit from the health officer, as prescribed in Section 3 of these Regulations." These milk regulations, in the Alabama system, are only effective in those counties in which they are adopted by the county boards of health.

In some small cities, milk producers were using Grade A caps on milk bottles, although no milk control program was being conducted. Our experience with milk control in small communities made us reluctant to recommend mandatory grading in such communities. Therefore, the county boards of health were urged to adopt these milk regulations, or a short

regulation embodying the section quoted, primarily for the purpose of controlling the unauthorized use of Grade A bottle caps. Following the adoption and enforcement of these cap controlling regulations in certain counties, we began to receive inquiries from milk producers for information and instructions concerning the production of Grade A Milk. This development set the stage for milk control in these smaller communities on a basis of voluntary compliance with Grade A Milk specifications.

This voluntary grading plan is very simple in operation in that no one is permitted to use a Grade A designation on the bottle cap except those that have complied with the Grade A Raw Milk specifications of the Milk Regulations, and who hold an unrevoked permit from the county and state health officer, and that placards are posted in all soda founts, cafés, stores, etc., advertising the use or sale of Grade A Milk, when milk of that grade only is purchased. When the quality of any supply falls below Grade "A", the use of Grade B, or lower grade caps is not mandatory; instead, the use of Grade A caps is immediately discontinued and plain caps bearing no grade designation are used, and the placards are removed from the establishments selling this particular supply. All dairymen participating in the voluntary grading program are informed that their competitors will not be required to meet the Grade A specifications, and that no effort will be made to stop or curb the sale of ungraded milk.

EXPERIENCE WITH NEW PLAN

Our experiences with this plan have been varied and interesting. In one town, the Standard Milk Ordinance had been passed in 1924, and, by 1936 had become just another ordinance on the records of the City Clerk, the local political situation making enforcement impossible. All dairies were using Grade A caps; back yard dairies were doing a flourishing business; and the dairies so proudly venturing forth in 1924 as Grade A had degenerated to such an extent that the milk sanitation rating was 38.5, and about the only specification that was being met was the use of *covered milk pails*. Upon the adoption of the State Milk Regulations by the board of health of the county in which this particular town was located, the city council, at the suggestion of the State Health Department, adopted an ordinance which made illegal the unauthorized use of bottle caps indicating graded contents, and repealed the mandatory grading ordinance which was still in effect but not enforced. Shortly thereafter, one of the original Grade A dairies complied with the latest grade A requirements, soon absorbed one of its former competitors, and now enjoys all the business it can handle.

Another town presents a very different picture, one not so bright and rosy. This particular town adopted the compulsory grading ordinance in 1931. The enforcement of the ordinance, after several years of successful operation, became rather lax, several factors influencing the actions of both the health officer and the city officials. The first factor was that, of the three recognized dairies being graded, one was operated by a county commissioner, another by a member of the legislature, and another by a man who was related to a member of the county board of health. The second factor consisted of the fact that several members of the city administration were selling milk from family cows. They endeavored to correct the situation by amending the milk ordinance to require the sale of grade A milk at soda founts, restaurants, stores, etc., but to permit the sale of ungraded milk to the homes. The dairymen very naturally protested the authorized sale of ungraded milk, but, at the same time, failed to maintain the sanitary standards at their own establishments. In 1936, an attempt was made to remedy the situation through the inauguration of the voluntary grading plan. The same factors that impeded enforcement of the milk ordinance prior to 1936, still obstructed the operation of the voluntary grading plan, in-so-far as the use of Grade A caps during periods of degrading was concerned. However,

the plan was beneficial to the extent that Grade A caps are not used on any milk except that of the two remaining commercial dairies.

A still different situation presented itself in another community. An established pasteurizing plant became interested in the distribution of Grade A Pasteurized Milk. The plant was repaired and remodeled, some new equipment installed, and, by stretching a few points, a Grade A rating was obtained. The dairies supplying milk to this plant were, accordingly, placed under supervision. The improvement program antecedent to the grading of these supplies resulted in the erection of a number of new dairy structures and the opening to some of them of a more lucrative market in another milk shed. In September of this year, the output of this plant was degraded because of the deterioration of the building and equipment, and the use of Grade A Pasteurized Milk caps was discontinued. The shippers to this plant are still endeavoring to produce grade A supplies, and the results of a survey of these dairies will be presented later.

The dairies operating under the voluntary grading plan are inspected, in all cases, by the sanitation officer of the county health department. He is given technical advice and assistance by the district inspector of the Division of Inspection of the State Health Department. Permits are signed jointly by the County Health Officer and State Health Officer upon the recommendation of the sanitation officer and the district inspector. None of the county sanitation officers now engaged in dairy inspection where the voluntary plan is in effect, has a milk inspection background; all have had to be taught the very fundamentals of milk control by the district inspectors. Milk samples are collected by the county sanitation officers, and are shipped in iced containers to the nearest State Branch Laboratory for examination. The entire procedure of inspection, sampling, grading, and degrading is based on the 1934 edition of the U. S. P. H. S. Milk Ordinance and Code.

GENERAL RESULTS

Fifteen retail raw milk dairies, in seven counties, are now operating under the voluntary grading plan. These dairies are selling in 11 small communities, the largest of which, according to the Census of 1930, has a population of 5,208, the smallest 791, the average size being 1,100. In one of these communities, seven dairies are supplying a pasteurizing plant that has recently lost it grade A rating. The average daily sales of the retail raw dairies are 45.6 gallons, the largest being 80 gallons, and the smallest 15 gallons. The average daily shipment to the pasteurizing plant is 43 gallons, the largest being 80 gallons and the smallest 25 gallons. It is estimated that the retail dairies are selling approximately 56 percent of the market milk sold in these eleven communities.

A survey of these dairies was made in September of this year. This survey was made in much the same manner as the U. S. P. H. S. milk sanitation rating surveys; however, in this instance, it was based upon strict compliance with the State Milk Regulations. At the retail raw dairies, 81.6 percent of the items of sanitation were in compliance and the sanitation rating was 82.8. At the prepasteurized dairies, 84.3 percent of the items of sanitation were in compliance, and the sanitation rating was 86.4.

A study was made of the frequency of inspection, bacterial quality, and delivery temperatures of these dairies for a period of six months, from April 1st through September 30, 1939. Twelve of the retail raw dairies were in operation during the entire six months, three operated only three months. Seventy-one inspections were made during this six month period, at the rate of 0.9 inspection per dairy per month, or one per dairy every 4.8 weeks. The prepasteurized dairies were inspected at the rate of 0.7 inspection per dairy per month, or one per dairy every 5.6 weeks. A total of 94 retail raw milk samples were collected, at the rate of 1.2 samples per dairy per month, or one sample per dairy every 3.6 weeks. The logarithmic average of the bacterial counts was 11,250. Of these, 84.0

percent were under 50,000, and the bacterial count compliance rating was 88.9. The delivery temperature was recorded for 91 of the 94 retail raw milk samples, the arithmetic average of the temperature readings being 47° F., 79.1 percent of the temperature readings were under 50° F., and the temperature compliance rating was 91.6. A total of 34 samples were collected from the prepasteurized supplies, the rate being 0.8 sample per dairy per month, or one sample per dairy every 5.3 weeks. The logarithmic average of the bacterial counts was 35,000. Of these, 85.2 percent were under 200,00, and the bacterial count compliance rating was 69.6. The arithmetic average of the temperature readings of the milk delivered to the pasteurizing plant was 50.1° F. of which 57.6 percent were under 50° F., and 100 percent were under 70° F. The temperature compliance rating was 81.2.

The dairymen in the small communities are displaying a growing interest in this voluntary grading plan. Two new dairies and a remodeled dairy will be ready for grading in the next few weeks. Competition in one instance and public demand for graded milk in the other instances were the motivating factors. We hope that many others of the 103 communities of 1,000 to 10,000 in Alabama will have graded milk available in the next few years.

There has been no attempt to present in this paper a beautiful picture of our voluntary milk grading program in Alabama. The cold figures and mathematical calculations indicate that much work remains to be done. The county sanitation officers must be trained to do more effective dairy inspection work, and the dairy operators must be educated to employ more sanitary practices, and continually to improve their equipment.

CONCLUSIONS

Realizing the incompletely satisfactory results achieved by this voluntary program, which, incidentally, has not received during the past several years the administrative attention it deserved, it must be pointed out that the quality of a certain percentage of the milk in these eleven communities has been improved. Certainly the level of safety achieved in this proportion of the milk supplies in these communities has been higher under this program than was the case with a mandatory grading program, inadequately enforced.

Although we realize that the policy of encouragement of voluntary production of Grade A Raw Milk does not protect the entire population, and is far from a perfect program, still we believe it has very distinct advantages over the policy of mandatory compliance with milk regulations in small communities. These apparent advantages include:

1. The milk producers enter the program voluntarily and look upon the milk inspector as a promoter or educator rather than as a policeman or an enforcement official.

2. Milk producers are less reluctant to remove Grade A caps, thereby reducing the number of court cases. Any court cases resulting from failure to remove Grade A caps would receive more enthusiastic support from small town officials than would cases resulting from failure to use lower grade caps.

3. The health officer can adovcate the use of Grade A milk without implying that producers of ungraded "family cow" milk are law violators.

Has The Approved Inspector System Promoted Uniformity? *

Ralph E. Irwin

Director, Bureau of Milk Sanitation, State Department of Health, Harrisburg, Pa.

In 1919 the Commissioner of Health of Pennsylvania invited representatives of milk producers, milk distributors, consumers, state health officials, and municipal health officials to come to Harrisburg to consider milk regulations from a public health standpoint. From the group of seventy attending the meeting, a committee of sixteen was selected to proceed with the preparation of dairy farm and milk plant requirements.

From the beginning it was agreed that the milk distributor was responsible for the condition of the milk he sold. Therefore he should have an accurate knowledge of the conditions on the farms from which he purchased milk and in the plant where the milk was prepared for sale to the consumer. The milk distributor agreed with this conclusion, and some were already making periodic farm inspections. The milk producers replied that they too were in favor of farm inspections by the distributor and the health officials but the qualifications of the inspectors were frequently such that farm conditions were worse after inspection than before.

The committee of sixteen prepared its findings in the form of an Act which was approved by the Governor on May 2, 1929. This Act defined the "Approved Inspector" and required every applicant for or holder of a permit for the sale of pasteurized milk to have the farms from which milk was purchased inspected by an Approved Inspector. The 1929 Act was repealed by an Act approved by the Governor on July 2, 1935, which is in effect today.

The 1935 Act defines the Approved Inspector as follows:

"'Approved inspector' is one, who has proved to the satisfaction of the secretary, to be a person of good character, trained by school and experience to carry on dairy farm and milk plant inspection in a capable and efficient manner, and has received a certificate of approval from the secretary. Applications for certificates of approval for approved inspectors shall be made on forms which may be secured from the Secretary of Health, and shall be accompanied by a fee of ten ($10) dollars. Certificates of approval shall expire on December thirty-first of each year. Applications for renewal shall be made on forms satisfactory to the Secretary of Health, and shall be accompanied by a registration fee of three ($3) dollars, and shall be returned to the Secretary of Health not later than December fifteenth of each year. Certificates of approval shall not constitute an approved inspector, an official employee, agent, or authorized representative of the Department of Health, nor shall he represent himself so to be.

"Certificates of approval may be refused, suspended or revoked for cause, upon such notice and subject to such conditions as the secretary shall deem necessary."

The requirement for farm inspection by Approved Inspectors is set forth in the same Act as follows:

"An accurate report of a sanitary inspection on all dairy farms from which milk is received and of the milk as delivered to the milk plant shall be kept on file in the milk plant. The sanitary inspection shall be made semi-annually, by an approved inspector at the expense of the applicant for or holder of a permit. Such payment shall be made only by the applicant for or holder of the permit for the plant to which the milk from the farm which is inspected is or is to be delivered. Such inspections may be made by the secretary. Within thirty days after demand by the secretary, additional inspections shall be made of any or all farms, and reports thereon filed in the milk plant. Inspection reports shall be made upon forms satisfactory to the secretary.

"No applicant for or holder of a permit to sell pasteurized milk or milk for pasteurization or milk products shall receive milk from a dairy farm until the report of the sanitary

* Presented at the 13th Annual Meeting of the New York State Association of Dairy and Milk Inspectors, Syracuse, September 27-29, 1939.

inspection made by an Approved Inspector shall have been placed on file in the milk plant where the milk is received for the inspection and approval of the secretary, nor shall he receive milk or milk products from any milk plant owned or operated by another person who is not in lawful possession of a permit."

The Secretary of Health (formerly Commissioner of Health) provides application blanks for those who desire to become Approved Inspectors. On the receipt of an application a written examination is given and the applicant is interviewed by a representative of the Bureau of Milk Sanitation. Applicants found satisfactory are issued a Certificate of Approval which may be renewed annually. Today there are 371 inspectors approved by the Secretary of Health.

Out-of-state milk supplies are covered by Pennsylvania Approved Inspectors the same as within the state. These inspectors may be employees of the out-of-state milk distributor. A number of Approved Inspectors within the state have sufficient clientele among the relatively small milk distributors to keep them employed througout the entire year. Distributors of raw milk are not required to have their farms inspected by Approved Inspectors. Under our present Act the Approved Inspectors cover the farms from which milk is sold for the preparation of pasteurized milk and the preparation of milk products which include ice cream.

The Approved Inspector employed by the distributor makes inspection reports to his employer recording the manner in which the farms comply with the law and regulations of the State Department of Health. The distributor, of course, may add requirements of his own.

A representative from the Bureau of Milk Sanitation checks the reports of the Approved Inspectors on file in the plant to which the milk is delivered. Should the check inspection indicate that farms are not meeting requirements, a reinspection may be called for and those farms excluded which do not meet requirements. The employment of Approved Inspectors has promoted uniformity in farm inspection because:

1. The Approved Inspector is required to be a person of good character, trained by school and experience to carry on dairy farm inspection in a capable and efficient manner.
2. He is employed by and responsible to the applicant for or holder of a permit to sell pasteurized milk, milk for pasteurization, or milk products.
3. The inspection blank used by the Approved Inspector contains the requirements of state law and regulations as a minimum, and to these the milk distributor may add farm requirements of his own.
4. Representatives of the Bureau of Milk Sanitation in the State Department of Health meet frequently with small groups of Approved Inspectors to discuss the requirements of the farm inspection blanks so that uniformity may predominate.
5. Producers' organizations assist in the preparation of dairy farm requirements and inspection blanks and are therefore acquainted with dairy farm regulations. With this information at hand the producer may demand and obtain uniformity.

Such a procedure is not new. It appears in many professions such as medicine, law, public education, et cetera.

Low Bacteria Counts in Milk with Tryptone Agar at 32° C.

Theodore Marcus

Massachusetts Dairy Laboratories, Dorchester, Mass.

At the annual convention of the American Public Health Association, 1938, a new medium was adopted for use in the bacteria count of milk to be used at a 35-37° C. incubating temperature. On April 28, 1939, the Boston Board of Health adopted the new medium, effective on that date, using a 32° C. incubating temperature. The present bacterial standards for the various grades of milk were left unchanged. Subsequently, effective, January 1, 1940, the standards were cut in half, establishing them as follows: 5,000 colonies per cc. for Grade A pasteurized milk and 20,000 for Grade B.

Although only one summer has gone by, we do know that it is possible to maintain the low bacteria counts to which we have become accustomed in the past few years by using tryptone agar at 32° C. and in most cases improve upon them.

The new medium is especially favorable to *S. lactis*, and there have been sharp increases in those raw milks that have not been properly cooled. In general, bacteria counts on raw milk using the new medium are comparable with microscopic counts on the same milk without a correction factor. On raw milks which have been contaminated with dirty equipment, bluish colonies show up in large numbers. The factor in keeping down the raw milk count with tryptone agar is proper cooling at the farm and country station and during transportation to the city.

On pasteurized counts, a number of new factors enter in. Some of the better milk showed lower counts in the new medium. On the other hand, some pasteurized milk showed sharp increases in the bacterial counts. An example of this was a raw milk from one creamery which had always averaged a pasteurized count of 4,000 colonies per cc. on beef extract agar as against a 36,000 pasteurized count on tryptone agar.

In the development of short-time pasteurization in Chicago, the investigators encountered bacteria which the treatment would not kill (1). In general, the same difficulty is met in securing low counts on pasteurized milk with the new medium. A very high count raw milk—400,000 colonies per cc. if the cause is poor cooling—will pasteurize well, showing a final count as low as 1,000. If the source of contamination is dirty equipment, however, or an open seam in a milk pail or jug, an unclean strainer cloth, or an improperly sterilized milking machine, the pasteurized count will be high. To secure low pasteurized counts at 32° C. incubation, it is necessary to pasteurize samples of each farmer's milk, and to inspect those farms from which milk with a high pasteurized count is coming.

The mechanics of such a procedure are not difficult. A constant temperature bath, with an agitator, to hold 96 samples can be constructed for $35. The milk samples are placed in the water bath after it reaches 144° F., kept there 40 minutes, and then cooled in ice water. Samples so treated react negatively to the phosphatase test.

Inspection of farms showing high pasteurized counts reveals that most of the trouble is caused by dirty milking machines, although no where near the 90 percent reported in Chicago. Open seams in pails and jugs is an important factor. Yellow scum around the seam in milk pails and soap powder are contributing factors. Inspection of one farm three times failed to reveal any possible cause

for high counts until the pick-up truck driver disclosed that a strainercloth was being used instead of a single service filter pad. The correction of this practice caused the pasteurized count to drop from 24,000 to 2,000 colonies per cc.

In many instances the farmers are not to blame at all. The can-washer is one of the most important sources of high pasteurized counts. Unless the seams of the jugs are tight, however, even a washer functioning properly cannot do a thorough job. A periodic inspection of farmers' jugs will show up the poor ones, and also reveal the kind of performance the washer is rendering. City jugs, tanks, and raw milk lines will contribute towards a high pasteurized count unless this equipment is properly washed and sterilized.

Comparing laboratory pasteurization with plant pasteurization, the plant will average 25-33 percent lower than the laboratory pasteurization. In those instances where the plant-pasteurized milk shows a higher count than the laboratory pasteurized samples, there is something radically wrong with the equipment or plant operations. The same bluish colonies mentioned earlier in connection with raw milks will show up occasionally on pasteurized plates. The presence of such colonies indicate contamination after pasteurization or improper pasteurization.

Using the new tryptone agar at 32° C., it is possible to obtain low bacteria counts in commercial practice. To keep the raw milk count down, the milk should be cooled properly and sanitary practices followed. To keep the pasteurized count down, the equipment on the farm and in the plant should be cleaned effectively.

REFERENCE

(1) Introduction into Chicago of the high-temperature, short-time method of milk pasteurization, by P. F. Krueger, *J. Milk Technol.* **1**, No. 7, 29 (1938).

Standard Strains of Salmonella

The Department of Animal Pathology of the Kentucky Agricultural Experiment Station has been designated as a National Salmonella Center by the International Salmonella Center at the State Serum Institute, Copenhagen, Denmark. The International center, which was established through the cooperation of the Commonwealth Fund, is under the direction of Dr. T. Madsen and Dr. F. Kauffmann. Its purpose is to stimulate the study of organisms of the genus Salmonella, to assist in the identification of cultures, and to serve as a repository of standard strains.

The department will now undertake the identification of cultures of the genus Salmonella which are submitted to it for study. Further, it is ready to supply standard strains to laboratories wishing to specialize in the study of the genus. These cultures were received from the International Salmonella Center as authentic representatives of the various serologic types.

A collection of 100 different cultures of the genus Salmonella is carried by the department. The names, together with identity and antigenic formulae, are listed in this publication, available by writing to the Station at Lexington, Ky.

The Pan American Sanitary Bureau and Its Cooperative Work in the Improvement of Milk Supplies

Hugh S. Cumming

Director, Pan American Sanitary Bureau, Washington, D. C.

As an introduction to the subject matter of this paper, it may be well to explain what is the organization which I have headed since 1920, its scope, duties, activities, and accomplishments.

To those accustomed to the smooth, efficient, and comparatively uniform working of quarantine operation, it may be hard to realize that even in the early part of this century arbitrary and often drastic procedures were practically the only methods used to prevent the introduction of disease in the various ports. Long detention and harsh restrictions handicapped commerce among nations and proved costly when not paralyzing all trade. Acting with wisdom and true foresight, a number of public health statesmen of all our republics decided to put an end to this embarrassing and awkward situation. As a result of their combined efforts, the Pan American Sanitary Conferences and the Pan American Sanitary Bureau came into existence. It is because of the continued activities of these two bodies that the old and faulty systems have been gradually discarded, scientific and fairly standardized quarantine measures established on our continent, and new developments made the subject of conference and discussion among health authorities in order to determine whether changes or new interpretations are required in our quarantine regulations. The benefit of this arrangement to international trade and comity can hardly be overestimated and is apparent every day.

ORGANIZATION

The Pan American Sanitary Bureau, an independent official public health organization, was created by the Second International American Conference (1901-02), organized by the First Pan American Sanitary Conference (1902), and reorganized by the Sixth (1920). It is governed by a Directing Council elected, together with the Director, at each Pan American Sanitary Conference, and supported by annual quotas contributed *pro rata* by all the American republics. On this Council, all the republics are represented by rotation at each Conference.

In point of time, our Bureau is the oldest of the great international health bodies, it having come into existence several years before the International Office of Public Hygiene of Paris, and two decades before the Health Section of the League of Nations. Another point worthy of note is that, while the two organizations named have performed work of the highest value, neither of them has been able to enlist in its membership all the countries included in its field of activities. On the contrary, the Pan American Sanitary Bureau is actively supported by all the American republics, and all of them share in its work and achievements. Perhaps the best evidence of its effectiveness is that an increase in its maintenance funds was approved in the Tenth Pan American Sanitary Conference, promptly ratified by the majority of the Governments concerned, and favorably recommended in the others as well as by the Eighth International Conference of the American States, which met in December, 1938 in Lima.

In addition to the staff in Washington, including an Assistant Director, Secretary, Editor, legal assistant, translators, etc., the Bureau maintains in the field a force consisting of four traveling representatives,

two sanitary engineers, and one epidemiologist. Trips to the different countries are also made from time to time by members of the Washington staff. All the field work is pre-eminently on a co-operative basis with the National Health Departments.

Under the provisions of the Pan American Sanitary Code (1924) the Bureau has become the center of coordination and information in the field of public health in the American republics. It also acts as a consulting body at the request of national health authorities, carries on epidemiological and scientific studies, and publishes a monthly Bulletin as well as other educational material. While primarily interested in the prevention of the international spread of communicable diseases, it is also naturally concerned in the maintenance and improvement of the health of the people of the twenty-one American republics.

Adjustment of quarantine matters long remained the main subject in sight for Pan American health co-operation. For nearly two decades, the Bureau itself was more or less a paper organization, showing hardly any signs of life between conferences. It is a source of some gratification for me to recall that, starting with my election as Director at the Sixth Conference in 1920, the Bureau began the most active and useful period of its life. A few dates will make this clear:

1920. Complete reorganization, and increase of appropriation from $5,000 to $20,000 a year. Only one employee on the staff.

1922. Offices established and publication of Bulletin started.

1923. Officer detailed to visit South American countries.

1924. Appropriation increased from $20,000 to not less than $50,000. Seventh Pan American Sanitary Conference held at Habana, at which the Pan American Sanitary Code (first treaty to be ratified by all the American Republics) was approved.

1926. A full-time Assistant Director appointed. First Conference of National Directors of Health held in Washington.

1927. Eighth Pan American Sanitary Conference held in Lima. Four employees on Washington staff.

1928. Full-time editor appointed, additional personnel retained, and scope of Bureau enlarged.

1929. First session of Directing Council held in Washington. First field employees (one Traveling Representative and one Epidemiologist) appointed for duty in the campaign against plague initiated on the western coast of South America.

1930. Mailing list of Bulletin vastly increased.

1931. Additional officers of the United States Public Health Service detailed to Bureau. Second Conference of National Directors of Health held in Washington.

1934. Ninth Pan American Sanitary Conference held in Buenos Aires.

1936. Third Conference of National Directors of Health held in Washington. Appointment of a Pan American Committee on Nutrition.

1937. Sanitary Engineers retained by the Bureau and assigned to duty in Latin America.

1938. Tenth Pan American Sanitary Conference held at Bogota, Colombia. Appropriations for maintenance practically doubled.

1939. Headquarters staff of the Bureau, 14; field staff, 6. Practically all American countries visited by representatives of the Bureau. Circulation of Bulletin, mostly among physicians and public health workers, 9,000.

The original *raison d'être* of the Bureau was, as pointed out before, standardization of quarantine procedure. This was the outstanding sanitary problem at a time when yellow fever ravaged periodically in both the countries South of the Rio Grande and our own Southern States; when plague had just gotten a foothold in the Western Hemisphere; when memories of the last epidemic of cholera were still fresh in the minds of the people; when the benefits of smallpox vaccination still failed to reach hundreds of thousands; and the cause of typhus fever remained unknown.

As each of these scourges was gradually being brought under control, as public health organization began to get better rooted and expanded from mere defense against epidemics to actual and constant prevention work, the Bureau was

called upon to act and furnish advice on many different subjects, all of them resulting from the development and growth of health activities throughout Latin America, which, in its turn, the Bureau was also helping to expand and organize on a solid basis.

Article 56 of the Pan American Sanitary Code grants all necessary powers in this direction. As information and advice as to methods of combating disease and maintaining health was solicited and furnished, consideration naturally had to be given to epidemiological features, including vectors and vehicles of disease and, of course, insects, water, food, milk, etc.

MILK WORK

The awakened interest in such problems as infant mortality, child welfare, and better nutrition necessarily led both health authorities and physicians in Latin America as elsewhere to an earnest and careful consideration of questions connected with milk from various standpoints. The most complete food man has at his disposal, and almost essential in childhood, milk also involves positive risks when not properly produced and handled.

The Pan American Sanitary Bureau had also begun of its own accord a series of efforts along the same lines. Beginning in 1928, papers have been published from time to time emphasizing the value of milk as a food, especially in childhood, and methods to be used in order to insure a safe supply. The translation into Spanish and general distribution of the Standard Milk Ordinance (now Code) of the United States Public Health Service have exerted an influence on the movement for an increased consumption of milk and improvement of this product. In this connection, the work of the Pan American Committee on Nutrition, appointed by me in 1936, in accordance with resolutions approved at previous Sanitary Conferences, will undoubtedly prove to be of the greatest usefulness through the influence which its activities and reports have exerted and will continue to exert.

At a number of the recent Pan American Sanitary Conferences the subject has been fully discussed and resolutions on milk approved. The Eighth Conference (1927) recommended attention to modern scientific methods for production of safe milk and the need of a modern milk ordinance; the Ninth Conference (1934) expressed the need of cooperation among national and local authorities as well as with private bodies and individuals in order to secure an increased and better milk supply; the Tenth Conference (1938) recommended measures aimed at increasing the production and consumption of safe milk and milk products.

The activities of the Pan American Sanitary Bureau in this direction have led to frequent inquiries on the part of health authorities and others interested on a number of technical points, including construction of dairy barns, bovine tuberculosis, pasteurization methods, tests of effectiveness of pasteurization, organization and equipment of milk distributing stations, milk examinations, etc. Even on more than one occasion, drafts of laws or ordinances on milk have been submitted to the Bureau for advice.

A glance at conditions regarding milk in different Latin American countries may prove of interest.

Consumption of milk. It is a fact on which we have often commented in our Bulletin that milk consumption in Latin America is far below the amounts recommended in the United States as conducive to health. Consumption in Argentina is higher than in any other country represented in the Pan American Sanitary Bureau, namely, about 137 cc. a day *per capita.* In Buenos Aires itself it is more than twice as high, about 333 cc. In none of the other Argentine cities in this proportion reached, Santa Fe, with 200 cc. being probably the highest in the scale. In Chile, consumption is much lower, not more than 82 cc. *per capita,* although again here it is higher in the two largest cities, namely, Santiago (200 cc.) and Valparaiso (133 cc.). Consumption in Brazil is much lower, even Rio and São Paulo barely reaching 150 cc. *per capita.*

Among other Latin American cities, Habana probably has the highest consumption (above 250 cc.), Quito (220 cc.), Mexico City and Asuncion (about 200 cc.). Lima (133 cc.), Caracas (110 cc.), and Bogota (100 cc.), all have much lower figures and at that higher than those belonging to the smaller communities. Of course, these data must be considered as merely approximate, but they may also be accepted as suggestive of a phenomenon widely deplored by local physicians and health workers, namely, an inadequate consumption of milk, especially at the age when this food is most needed.

Diseases affecting cattle. Among diseases affecting cattle and therefore the quantity and quality of milk, tuberculosis occupies the foremost place. A number of surveys has been made in several countries to determine the extent of this problem. Partial studies have shown a 30-35 percent infection rate in Chile as a whole, and 20 percent in Santiago and the neighborhood. In Argentina, positive rates of 8-17 percent have been found in different areas. In Brazil, rates varying from less than 1 percent to over 20 percent have been reported, and in Venezuela from less than 1 percent to more than 50 percent. Figures for Puerto Rico and Jamaica have been less than 3 percent. The real menace lies in the fact that previously free areas have been infected after the importation of foreign breeds, and as open air pasture is abandoned for stables. Authorities in cattle-raising countries are, however, alive to this danger, and are gradually putting into effect plans for detecting and controlling the disease in animals.

Another condition, the presence of which was formerly unsuspected, has now been found in practically every American country. I refer to infectious abortion. The seriousness of this problem is being realized, and preliminary surveys have revealed prevalence rates as high as 80 percent in some herds in Chile. Active measures have been taken against this disease in a number of countries, especially Argentina. In Mexico, a Congress on undulant fever was held only a few months ago. Mastitis is also a prevalent condition, 39 percent of the cows examined in the Province of Santiago showing the disease. An even more serious condition is foot-and-mouth disease. Perhaps its worst danger consists in its occasional exacerbations. A recent epizootic in Chile has caused losses amounting to hundreds of millions of pesos and a decrease in milk production estimated as high as 50 percent.

Pasteurization. Properly performed, pasteurization will safeguard against the spread to man of diseases affecting cattle. The measure, however, is still fighting its way slowly into recognition in many places in Latin America. The pasteurized proportion of the total milk consumption is estimated at 85 percent in Rio, 75 percent in Santiago, less than 50 percent in Habana, about 40 percent in Buenos Aires, 10-40 percent in other Argentine towns, and 8 percent in Asuncion. As pointed out by the Bureau, however, on more than one occasion, inefficient pasteurization is worse than no pasteurization, since it creates a sense of false security. Much can be said in behalf of the practice of double boiling, so common in Latin America, with a view to preventing souring of milk.

Advance. Rules aiming to raise the sanitary quality of milk have been promulgated in practically all Latin American countries. A congress on milk has been held recently in Venezuela at which means for encouraging the raising of cattle and the upbuilding of the milk industry were discussed, and similar action has been taken or is being considered in other countries. While much still remains to be done, and the solution of the problem may prove difficult because of the many factors involved, the advances already achieved in Latin America deserve recognition and encouragement. We find everywhere a real desire to improve conditions and help the cause of health. In this field, milk sanitation has a definite and important place of its own, which is being increasingly recognized.

A Discussion of the International Classification of the Streptococci of Bovine Mastitis *

Ralph B. Little

The Rockefeller Institute for Medical Research, Princeton, N. J.

A cultural and serological study of the mastitis streptococci, instituted by Dr. Minett and the speaker, is being conducted by interested workers throughout the world. It seems appropriate at this time to tell about this study, since it is possible that it may result in the adoption of a classification of these organisms.

EXISTING CONFUSION IN CLASSIFICATION

Mastitis may be caused by several kinds of streptococci which are capable of producing different forms of the disease; but usually only one form spreads easily in the herd. In the literature, all types of streptococci, regardless of their cultural reactions or clinical manifestations, possibly have at some time been referred to or listed as *Streptococcus mastitidis*. Occasionally, critical fermentation or biochemical tests, which are so necessary for a clear classification, have been omitted. Each worker at the present time uses only those tests which he considers important, often omitting fermentation or biochemical tests which by other workers are considered essential. No standard cultural methods have been adopted, and so each worker has the privilege of using as few or as many differential tests as he desires. These variations in technique and terminology, however, make it difficult for laboratory workers to identify clearly the cultural strains of streptococci reported by various authors.

In 1929 Minett and his associates attempted to overcome this confusion by adopting a simplified workable scheme whereby the majority of the streptococci encountered in mastitis could be classified. In my bacteriological studies of the mastitis streptococci this classification has proved very useful and workable.

With the hope that this classification might be more widely used, I wrote to Dr. Minett to find out if he would be interested in a cooperative project to reclassify the mastitis streptococci according to his grouping. In my letter, it was suggested that workers studying mastitis be asked to reexamine cultures which they had previously reported as causing mastitis, as well as strains then under study, by simple uniform serological and cultural methods. Each worker participating, it was proposed, should use media prepared in the same manner as well as similar cultural tests. Moreover, it was suggested that new subgroups, or even new groups, might in this way be added to the classification presented by Minett at the 12th International Veterinary Congress. In other words, it might thus be possible once and for all to identify and classify the atypical strains which are apparently responsible for much of the confusion now existing in bovine mastitis.

Furthermore, in that first communication to Dr. Minett, I proposed that if he was agreeable to such a plan I should be glad to communicate with workers in this country in order to obtain this information for him. Dr. Minett was very much interested in the plan, and we at once got to work on the preparation of this material, by the rather slow method of a trans-Atlantic exchange of letters.

PLAN OF COOPERATIVE STUDY

At first we decided to inquire of various workers throughout the world by personal communication whether they would be interested in cooperating with

* Presented at the 13th Annual Meeting of the New York State Association of Dairy and Milk Inspectors, Syracuse, September 28-29, 1939.

us in this project. Later we realized that with such an approach, someone doing exceptionally fine work might be overlooked and thus be eliminated from participation in this study. It was finally decided to publish the first exchange of letters, comprising my request to Dr. Minett and his acceptance, together with a rough draft of the plan, in various veterinary journals so that anyone desiring to participate could do so.

In May, June, and July, notes describing this project were published abroad or in this country. It was announced in these communications (1) that simply by writing to either London or Princeton, anyone could receive our outline for the bacteriological and serological examination of their strains, a guide for the classification, sheets to record his results, and Group B serum very kindly supplied gratis by the Lederle Laboratories, Inc.; (2) that the results of this study would not be published until everyone cooperating with us had had an opportunity to go over them; (3) that if atypical strains were encountered which could not be classified according to Minett's grouping, each worker had the privilege of sending such strains to either one of these centers for further study; and (4) that, in addition, type strains would be available for comparative purposes to anyone requesting them.

Following these announcements, we had many enthusiastic requests for our material.

Bacteriologists may take exception to some of our procedures, but it should be borne in mind that our aim has been to make the methods so simple that they could be used in almost any laboratory. The authors who cooperate with us in the cultural study of their strains will have an opportunity to offer criticisms or suggestions which should make the final report on the cultural methods of more value.

ADVANTAGES OF STUDY

If the results of this study are published, what will be the advantages to the worker interested in bovine mastitis?

A. It should serve as a standard guide for the cultural classification of the mastitis streptococci, since the final results will represent the findings of authors throughout the world. Such a study may be the means of developing a workable program whereby workers interested in mastitis may adopt comparable cultural methods and a universal classification and terminology in reporting their findings.

B. It should be of exceptional value to new workers in this field of research, to Boards of Health, and to laboratories not directly concerned in the epidemiological study of the disease.

C. It should decide once and for all whether the mastitis streptococci should be designated by groups, by numbers, by letters, or by names.

D. This study will form a sound basis for continual revision of the report finally adopted as newer methods are developed to supplant the ones now in use, or as new strains of streptococci are identified.

E. After it is once recognized by various workers that certain cultural types of streptococci are responsible for different forms of mastitis, it may be possible to study more thoroughly the epidemiology of the disease.

PRESENT TERMINOLOGY

It has been shown by Lancefield that nearly all the hemolytic streptococci pathogenic for human beings belong to her serological Group A. On the other hand, the hemolytic and non-hemolytic streptococci associated with the more common form of chronic mastitis (designated by Minett as mastitis streptococcus Group I, or *Str. agalactiae*) belong to another group designated by Lancefield as serological Group B. Certain hemolytic human strains and those from the horse and other animals comprise Lancefield's serological Group C. Recently it was shown by the speaker that alpha hemolytic mastitis streptococci usually responsible for a more acute form of the disease, that is, mastitis streptococcus Group II, or *Str. dysgalactiae*, belong to serological Group C. Lancefield and other workers recognized

TABLE I

TABLE 1

Form to be used by authors in recording the results of the examination of mastitis streptococci

No. or designation of strain (with approximate date of isolation)	Ox-blood agar	Final pH in glucose broth	Sucrose	Salicin	Mannite	Inulin	Raffinose	Aesculin	Sodium hippurate	Litmus milk	Methylene blue milk	Test with Grouping serum	Grouping of strain
Culture B1 1933	Alpha or non-hemolytic												
Culture C 1936	Double zone beta hemolytic	4.4 to 4.8	+	±	—	—	—	—	+	A.C.	—	B**	Mastitis streptococcus Group I *(Str. agalactiae)* Minett[1]
Culture R9 1936	Narrow zone beta hemolytic												
Culture A1 1933	Alpha hemolytic	4.8 to 5.0	+	—	—	—	—	—	—	A.C.R.	R.C.	C**	Mastitis streptococcus Group II *(Str. dysgalactiae)* Minett[1]
Culture 23 1938	Alpha or non-hemolytic	4.7 to 4.9	+	+	+	+	—	+	+	A.C.R.	R.C.	E**	Mastitis streptococcus Group III *(Str. uberis)* Minett[1]

** Lancefield's serological grouping.

A.=Acid; C.=Coagulated; R.=Reduced.

Note: Use of sorbitol and trehalose is optional. Results of these tests to be appended on separate sheet.

Mastitis streptococcus Group I —*Str. agalactiae* — Sorbitol—, trehalose +.
" " " II —*str. dysgalactiae* — " ±, " +.
" " " III—*str. uberis* — " +, " +.

Note: References to publications in which strains reported above were described are also to be appended on separate sheet.

[1] Minett, F. C. Proc. Twelfth Internat. Vet. Cong. **2**, 511 (1934).

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additional groups designated as D, E, F, G, H, and K. Certain hemolytic strains of streptococci belonging to Group G occur in dogs, and strains of streptococci have been recovered from market milk which serologically fall into Group D. On the whole, streptococci comprising Groups E and F are of lower pathogenicity. It has been reported, however, that certain mastitis streptococcus Group III strains, *Str. uberis,* belong to serological Group E. Occasionally these strains are responsible for acute mastitis.

The statement has already been made in this paper that each worker participating in this project received an instruction guide and mimeographed sheets to record his results.

In Table I is shown the form to be used by an author in reporting the cultural results of (1) new strains, (2) those showing typical group characteristics (I, II, or III), and (3) those previously reported in literature (but not hitherto identified according to Minett's classification). The strains of mastitis streptococci reported in Table I comprise the three well-recognized groups of streptococci described by Minett.[1] The reference to the publications of an author and miscellaneous data such as the reaction of strains in sorbitol and trehalose are to be recorded on a separate sheet of paper.

Report of the Committee on Education and Training

H. E. Miller, *Chairman*

There are obviously at least two classes of personnel engaged in milk sanitation:

(a) Persons employed full time, such as in directing milk control activities of cities, and rendering advisory and consultative service to local health departments, and

(b) Engineers and sanitarians in both state and local health departments whose duties include milk sanitation to a greater or less degree.

Although successful milk control officials have usually been trained in dairy science, veterinary medicine, sanitary engineering, or the biological sciences, there seems no disagreement on the point that no single one of these courses of training provides the equipment needed to prepare adequately the person who wishes to specialize in milk control.

The fact, however, that so many workers in milk sanitation have been trained in one of the indicated professions or sciences suggests the advisability of determining the elements in the scientific training of each of these groups that provide the most specific preparation for milk control.

Having in mind the significance of milk control as a major health measure, the committee will undertake to study subjects, coupled with basic public health training, that it believes should provide satisfactory training for this particular field of service.

The committee feels that consideration should also be given to the second group of personnel, whose activities include milk sanitation. It is believed, however, that the recommendation for this group should be materially influenced by the study from which recommendations are formulated for the first group.

Finally, short courses for dairy inspectors offer considerable promise. In view of the satisfaction expressed as to results attained in the two and three day short courses that have been conducted in several states, the committee will undertake to summarize the scope and content of these courses with evaluations of accomplishment as can be obtained.

Respectfully submitted by the Committee

C. A. ABELE
SIDNEY LEETE
V. M. EHLERS
H. E. MILLER, *Chairman*

Abstracts of Technical Papers Presented at Thirty-first Annual Meeting of the American Butter Institute December 5-6, 1939, Chicago, Illinois.

Reported by M. E. Parker

New Developments in Mold Control

H. Macy
University of Minnesota

The creameryman who hopes to control the mold problem must fix his attention upon many details of operation from the time the cream leaves the farm until it reaches the consumer. The first step is the effective pasteurization of the highest quality of cream obtainable. Thereafter this pasteurized, mold-free cream must be protected just as far as possible from all re-contamination. This means especially that: (1) adequate sanitary methods must be applied to equipment of every description, from start to finish; (2) water, salt, and starter must be mold-free; (3) ventilation must be adequate enough to provide an atmosphere practically mold-free; (4) parchment liners or wrappers, tubs, and boxes must be mold-free; and (5) all workers must use necessary precautions to prevent transfer of mold-infection from hands or clothes to product, equipment, wrappers, or packages. Unfortunately even under practically ideal conditions, mold spores may find their way to butter surfaces, thereby necessitating other procedures to discourage the subsequent development of such adventitious contaminates. Such procedures include the following: (1) thorough working of the butter; (2) reduction of moisture droplets on surface of butter whether they are due to faulty workmanship, accidental wetting of surface, breaking of body by printing machines, defrosting, or any other cause; (3) treatment of parchment paper and packages with mold inhibitors such as salt, proprionates, etc.; (4) proper packing and use of wrappers or liners impervious to mold; (5) extreme care in defrosting or tempering butter in order to reduce moisture condensation; (6) storage at humidities as low as possible; and (7) storage at lowest possible temperatures at all times, specifically at or below 0° F. whenever practical.

The creameryman who follows most closely the recommendations made above, will be the one who has the least trouble with moldy butter.

New Aids to Better Cream

C. H. Parsons
Swift and Company, Chicago, Ill.

The results of a preliminary investigation of various methods of gathering cream for buttermaking indicate that the quality of cream is somewhat better maintained when held in containers of minimum surface area and not stirred during the gathering period rather than when held in the conventional cream can and stirred after each addition.

The owner of a small herd must necessarily do a tremendous amount of work in proportion to his production of butterfat. Accordingly, it would appear that an effective program of cream quality improvement would give due consideration to a technique of caring for cream that would reduce the cost of production for the owners of small herds, who incidentally provide the greater proportion of the cream used for buttermaking in this country. Therefore, the manufacturers, educational institutions, and agricul-

tural institutions are urged to collaborate on the following points although there may be other items equally as important:

1. More effective cleaning and sterilizing substances so that the washing and sterilizing of utensils can be simplified.
2. Effective means for straining milk before it enters the milk pail.
3. A sanitary container for holding cream that will permit its layering during the gathering period.
4. The development of more effective methods of cooling cream and maintaining the same during delivery to the creamery.
5. The development of more effective and simpler methods for cleaning farm separators.

Weedy Flavors

Laboratory Studies

Butter with a strong French weed odor and flavor (sometimes erroneously called "peppergrass") has been found to have an abnormally high indol content and the indol present has been tenaciously held in the fat. It appears to be indicated that cows are capable of throwing off indol in normal amounts but when large amounts of indol are formed during the digestive processes, the cow's system becomes overburdened with it and is unable to throw it off normally; hence, it gets into the milk and cream. In support of this theory, aqueous infusions of French weed were found to contain from 26.6 to 70.5 gamma of indol per gram, whereas, blue grass after 18 hours incubation contained only 11.5 per gram. Furthermore, acid hydrolysis of French weed produced only traces of indol which was also true of water infusions of French weed saturated with chloroform or toluene to inhibit bacterial action. The role of enzymes in the formation of indol from French weed has not been adequately studied as yet to justify any definite conclusions.

Field Observations

R. V. Hussong

In a series of studies made upon herds feeding in areas where milk and its resulting butter were affected with obnoxious weedy flavors, it was observed that a variety of weeds were in evidence. The weed commonly present and which was consumed readily by the cows was peppergrass (*Lepidium virginicum*). Although Frenchweed (*Thalspi arvense*) was present in some of the pastures, there was no evidence that the animals liked it or were eating it. Attempts to feed Frenchweed to cows in the barn were unsuccessful.

The flavor and odor of the abnormal cream and butter resembles the flavor and odor of indol and skatole.

While butter made from abnormal cream always had a high indol content it does not follow that all butter with a high indol content was made from weedy cream.

Trials in which cows were removed from weedy pastures indicated that it took approximately 48 hours for the indol content of butter from this herd to approach a normal value. This suggests that the high indol content of the abnormal fat may be the result of an accumulation of indol in the animal's body and that a considerable period of time is required for the accumulation to reach a point where the normal elimination mechanism can handle it.

New Books and Other Publications

The Vitamins, A Symposium Arranged under the Auspices of the Council on Pharmacy and Chemistry and the Council on Foods of the American Medical Association. Chicago, Ill. 637 pages. American Medical Association, 1939.

This book admirably summarizes the available knowledge concerning the practical aspects of vitamin studies. Compiled as a symposium by thirty authorities in this field, it includes over seventeen hundred references to the literature as late as that of the year of publication—an unusual devotion to utilization of the latest information. The chemistry, physiology, pathology, assay and food sources of the vitamin complexes A, B, C and D are clearly presented without obscuring detail. Useful tabloid arrangements of the complexes, precursors, and available foods assist the reader in getting a perspective of the field. Vitamin E is discussed in less detail, together with several of the other less known dietary factors. Particularly useful features are the descriptions of the numerous techniques used to assay the several vitamins, the discussions of the units of potency, and the human nutritive requirements. For the person busy in other fields, the book will supply much of the latest information to readers who want the subject presented clearly, interestingly and broadly.

J. H. S.

The Dairy Goat, by S. A. Asdell and J. C. Marquardt. 38 pages. Cornell Extension Bulletin, Number 414, Published by the New York State College of Agriculture at Cornell University, Ithaca, New York. June, 1939.

This publication describes and illustrates the breeds most frequently found in New York State. The subjects discussed are: Buying a goat, housing, care and feeding, milk production and handling, milk composition, utilization of surplus, breeding, sanitary handling, and treatment of diseases. A small useful bibliography is offered, together with a list of goat societies, books, and journals.

J. H. S.

What To Do In Case of Accident. Miscellaneous Publication 21, Federal Security Agency, U. S. Public Health Service. 71 pages. U. S. Government Printing Office, Washington, D. C., 1939.

The opening paragraph points out that it is entirely possible for any person of ordinary intelligence to master enough of the art of first aid to be able to give a great deal of valuable assistance pending the placing of the patient under regular medical care; and such help, if properly and promptly administered, may frequently, in severe cases, be the means of actually saving life. When a person is hurt or suddenly becomes sick it is almost as important to know what not to do as it is to know what to do.

The suggestions discussed are grouped under the following headings:

General rules as to what to do in case of accident
Wounds
Hemorrhage or bleeding
Shock
Bandages and bandaging
Miscellaneous minor injuries.
Fractures
Illnesses due to heat
Effects of heat and cold
Skin irritation from poison ivy
Suffocation
Unconsciousness
Poisoning
List of remedies and uses
List of surgical supplies for medicine chests.

The publication is clearly written and fully illustrated. All of the instruction is practical. It is presented in a form so that a person of ordinary intelligence can apply it. A copy should be available in every plant, and certainly in every laboratory.

Copies can be secured by writing to the Superintendent of Documents, Washington, D. C. Price, ten cents.

J. H. S.

JOURNAL OF MILK TECHNOLOGY

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International Association of Milk Sanitarians

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Association News

Michigan Association of Dairy and Milk Inspectors

The Michigan Association of Dairy and Milk Inspectors held their thirteenth Annual Meeting at the Civic Auditorium in Grand Rapids on March 6 and 7, 1940, with 165 persons in attendance for the sessions. Those who took part in the program and their subjects were as follows:

"What constitutes proper sanitation in the manufacture of ice cream."
Prof. P. S. Lucas, Michigan State College.

"The latest developments in dairy plant equipment and metals."
O. K. Burrows, Cherry-Burrell Corporation, Detroit.

"The consumers' right in a pound of butter."
Dr. Ira A. Gould, Michigan State College.

"Proper laboratory control in solving problems of sanitation."
Dr. W. L. Mallmann, Michigan State College.

"Problems of dairy plant wastes."
Prof. E. F. Eldridge, Michigan State College.

Four committees of the Association which jointly make up the Committee on Coordination of Requirements made their reports. These committees are coordinating dairy farm, milk plant, creamery sanitation, and ice cream requirements. The committees have made some very definite progress toward the elimination of over-lapping and contradictory ordinances and laws. All committees were continued with the same personnel.

It was voted to hold the summer short course or conference at Michigan State College the last three days of the second week in July.

H. J. BARNUM,
Secretary-Treasurer.

Missouri Association of Milk Sanitarians

The eighth annual meeting of the Missouri Association of Milk Sanitarians and Milk Control Short Course will be held at Eckles Hall, University Farm, Columbia, Missouri, on May 1, 2, and 3, 1940. The organizations cooperating are the College of Agriculture, Dairy Husbandry Department, Missouri State Board of Health, and the Missouri Association of Milk Sanitarians.

G. M. YOUNG,
Secretary-Treasurer.

New York State Association of Dairy and Milk Inspectors

The President, Dr. E. E. Brosnan of the New York State Association of Dairy and Milk Inspectors has appointed the following Committee on Local Arrangements for the coming annual meeting in New York City:

DR. CLYDE L. KERN, *Chairman*
DR. C. I. CORBIN
DR. E. ST. JOHN BALDWIN
MR. SAMUEL ABRAHAM
MR. HERBERT S. EASTWOOD
MR. C. SIDNEY LEETE
MR. W. D. TIEDEMAN

The chairman of this committee, Dr. Clyde L. Kern, has indicated that his committee has some very interesting plans for the entertainment of the members and particularly their wives.

This is the same committee as appointed by Dr. Paul B. Brooks, President of the International Association of Milk Sanitarians, making this a joint committee of the two associations.

W. D. TIEDEMAN,
Secretary-Treasurer.

Pennsylvania Association of Dairy Sanitarians

The next meeting of this Association will be held in Harrisburg at the Penn-Harris Hotel on April 16, 17, 18. Part of the time will be devoted to the joint session of the Pennsylvania Association of Milk Dealers, including a joint banquet on the evening of the 17th.

GEORGE C. MORRIS,
Secretary.

International Association of Milk Sanitarians

The Committee on Sanitary Procedure recently met in Chicago to study several pieces of equipment. On one day, they met with the Committee of the Motor and General Section of the National Electrical Manufacturers Association and considered the subject of enclosed motors.

The index to the twenty-five annual reports of the Association will soon be published, the work of Mr. Horatio N. Parker, of Jacksonville. This index is complete, including every paper and most of the discussions given during the first twenty-five years of the work of this Association. It will take the same shape and form as our former annual reports. The price will be $1.00. Copies can be procured from the Secretary-Treasurer.

C. SIDNEY LEETE,
Secretary-Treasurer.

Bang's Disease Suppressed in 209 Counties in 17 States

Practical eradication of Bang's disease from dairy and breeding cattle in 209 counties in 17 states has been announced by the Department of Agriculture. The counties were officially listed, as of February 1, as "modified accredited Bang's disease-free areas" by Dr. John R. Mohler, Chief of the Bureau of Animal Industry.

These gains indicate, Doctor Mohler said, that Bang's disease, regarded as the No. 1 enemy of cattle breeders, is yielding to the systematic campaign of eradication now being pressed by federal and state veterinary officials and livestock owners.

The States and number of counties in each, named in the official declaration are: Alabama, 3; Arkansas, 21; Florida, 1; Georgia, 28; Louisiana, 11; Maryland, 2; Michigan, 8; Minnesota, 2; North Carolina, 16; North Dakota, 4; Oregon, 5; Pennsylvania, 11; South Caroline, 2; Virginia, 72; Washington, 6; West Virginia, 14; Wisconsin, 3.

The 209 counties contain approximately 1,560,000 dairy and breeding cattle, six months of age and over.

The plan of testing and of designating areas parallels that used successfully in the campaign against bovine tuberculosis. Gains in suppressing the disease are the result of the work done in Bang's disease eradication both under the individual herd plan and on an area basis. The regulations provide that whenever results of testing the dairy and breeding cattle six months of age or over, except steers, for Bang's disease indicate that the percentage of cattle that reacted to the test did not exceed 1 percent of the cattle tested nor the infected herds more than 5 percent of the total number of herds, such a county can be declared a modified accredited Bang's disease-free area for 3 years by the cooperating state and federal officials in charge of the work, provided that all infected herds shall be placed in quarantine.

The cattle in those herds must be retested for the disease at intervals of from 30 to 90 days until all of them pass two consecutive negative tests and also pass a further negative test not less than 6 months from the date of the second negative test. The reactors are, of course, removed from the herds and disposed of in accordance with the state and federal regulations.

The state livestock sanitary officials in Arkansas, Pennsylvania, Virginia, and Washington, have announced previously that some of the counties in those states were qualified as state modified areas in the Bang's disease work. Co-operative state-federal work to control Bang's disease began in 1934.

Much progress has been made in reducing the degree of infection of Bang's disease in many other counties where the work is being conducted either on the

area or individual herd plan. Work on the area plan is now being conducted in 285 counties in 23 states in addition to those listed today.

The owners of cattle that react to the test for Bang's disease and are slaughtered are partially compensated for the loss sustained, by the Federal Government and the cooperating states. Under the provisions of the federal regulations, the owner cannot receive from the Federal Government more than the amount paid to him by the state or other cooperating agency. The owner also receives the salvage. The federal payment recently has averaged about $14.50; the state payment, $16.20; and the salvage, $34.90.

The notice, as applied to Bang's disease, is the first of its kind issued. As the work progresses the Bureau of Animal Industry will name additional counties in a similar manner. Officials can be kept informed of the progress of this work by requesting the U. S. Department of Agriculture to place their names on the mailing list of announcements.

"Doctor Jones" Says —

"Old Dr. Hemingway, that practiced here when I was a boy—I remember his telling me once about one winter night, being called in the middle of the night to see an old fellow that had a big place seven or eight miles out here on the Ravine road. He'd been awful uncomfortable, the old man had and the doctor did a little operation that relieved him. 'Doctor,' he says, 'that's worth a hundred dollars to me!' Six months later the doctor sent him a bill for fifteen and he had to threaten to sue him before he got it. That kind of gratitude, I've often noticed, it's like love: sometimes the worse they have it the sooner they get

"What made me think of it: all this debate about inadequacy of medical service, doctors' organizations being indicted for restraint of trade and so on—I think a lot of people are getting the idea that doctors are sort of an ornery lot—that they're running some kind of a racket or something. The way it looks to me, it's like a lot of this war news we've been getting: the more 'news' they get the less they know about the real situation. 'Actions speak louder than words,' as my mother used to say. I figure they'd hit it nearer right if they'd pay more attention to what their own doctors at home are doing and less to what the ones that get their names in the papers are saying.

"Doctors—well it's like Henry Smith says about horses. 'Hosses,' Henry says, 'they're like folks: there ain't none of 'em perfect.' They have their bad days, doctors do, and they get kind of uppish and all that but, if I do say it as shouldn't, there's an awful lot of folks that've had good reason to be glad the old doc was there when they needed him.

"Speaking of places without doctors, I know a place up above here: every now and then they send out an S.O.S. because they haven't got any doctor in the place. Well—they've had at least three and they've had to quit. The folks that're good pay, a lot of 'em, when the going's good they'll send over to the county seat and get one of the men over there. The only time they'll call the local doc is when they can't get anybody else. There's others, when it comes to paying—as somebody said: they wouldn't even pay his wife a visit. Not many doctors ever expect to get rich but, after all, they do have to eat.

"It might be a good idea if folks, every time they have reason to be grateful to their doctor, if they'd write it down so they wouldn't forget it. Then, if they'd have a meeting about once a year and compare notes—well, I've got an idea it would figure up that doctors aren't such a bad lot, at that."

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